ILLUMINATING ENGINEERING

DECEMBER 1954

Economics of Mercury for Industrial Areas
More Regional Lighting Contest Winners
Lighting a TV Set Assembly Plant
General Secretary Reports
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Unprecedented Multi-Function Wakefield Ceiling Installed in New Douglas Aircraft Design Center

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El Segundo Division of Douglas Aircraft

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Wakefield luminous ceiling covers 2 acres and integrates acoustical baffles, air diffusers, sprinkler heads and other basic electrical services.

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LIGHTING DATA

Maximum brightness of diffusers 150 footlamberts, with F-96T12 slimline standard white lamps spaced 36 inches on centers and located 24 inches above plastic diffusers.

6 inch deep acoustical baffles, also spaced 36 inches on centers, provide excellent shielding.

Maximum brightness of baffles between 50 and 60 footlamberts.

Light wall colors and finishes combine with high intensity low brightness lighting to create comfortable environment.

Windows glazed with tinted glass. South windows have solar-controlled vertically louvered aluminum shields outside.

Wakefield is proud to have been chosen to work with the management of Douglas Aircraft and their architects and engineers in the planning and building of this impressive new design center. A number of new brochures on the Wakefield Ceiling and Wakefield Geometrics, designed particularly for illuminating engineers and architects, have recently come off the press. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio. In Canada: Wakefield Lighting Limited, London, Ontario.

Wakefield Over-ALL Lighting

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THE CAVALIER

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THE COMMODORE

THE STAR

THE WAKEFIELD CEILING

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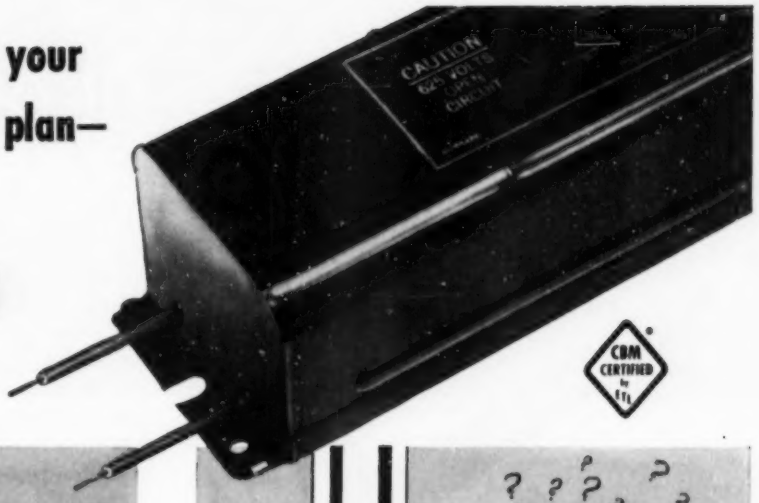
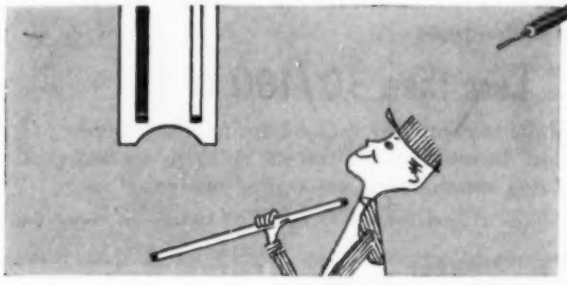




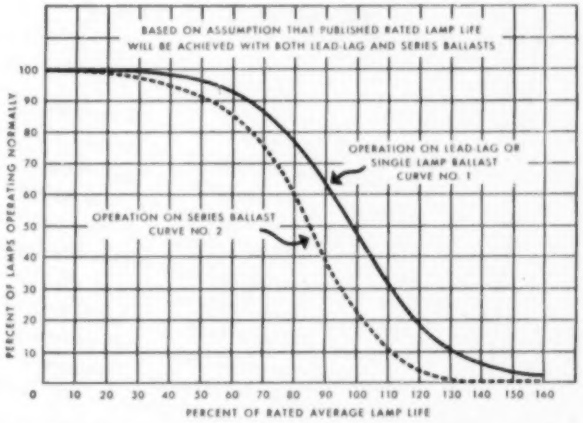
Lead-Lag—When outage of a single lamp occurs in a group of lamps operated on two-lamp *lead-lag* ballasts, the lumen output of the other lamp is not affected.

Series—When outage of a single lamp occurs in a group operated on two-lamp series ballasts, the operation of one other lamp *is impaired.*

All group lamp replacement plans are based on a curve showing the probability of lamp failure at a certain percentage of lamp life. The normal curve, as shown in Curve 1, is based on the principle that when a certain lamp fails, it does not affect the operation of any other lamp in the group—a lighting system using *lead-lag* ballasts.

When lamps (regardless of brand) are operated on series ballasts, failure of one lamp affects the operation of one other lamp in the group. The lamps are paired in their operation and the failure of one lamp in the pair causes the other to become totally inoperative or to operate at about ¼ of its normal light output. In either case the remaining lamp is not operating normally. Therefore, the probability curve applicable for group lamp replacement plans on lighting systems using series ballasts is shown in Curve 2.

Compare these curves. You will see an important increase in economy of *lead-lag* over series operation for installations using group lamp replacement. This


BASED ON ASSUMPTION THAT PUBLISHED RATED LAMP LIFE WILL BE ACHIEVED WITH BOTH LEAD-LAG AND SERIES BALLASTS
OPERATION ON LEAD-LAG OR SINGLE LAMP BALLAST CURVE NO. 1
OPERATION ON SERIES BALLAST CURVE NO. 2
PERCENT OF LAMPS OPERATING NORMALLY
100
90
80
70
60
50
40
30
20
10
0
10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
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ILLUMINATING ENGINEERING

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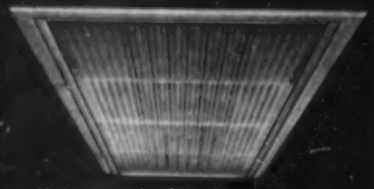

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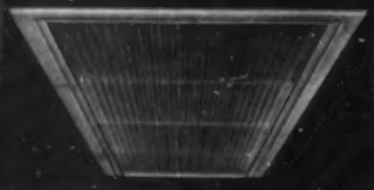

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A Light That is Kind to a Star Sapphire

LIGHTING that is "gemuetlichkeit"—and "kind" to a star sapphire were the terms used to describe what was wanted for this Milwaukee jewelry store. Unorthodox as this terminology may be, it does suggest appreciation of the plus-factor available from the lighting installation if properly undertaken. These very qualities, and more, were supplied by the four-way cooperation of lighting engineer, store designer, architect and electrician.

The store in question is an old, well-established concern of great reputation, now moved to a new location. Design feature of the new quarters stressed comfort and luxury, not only to compensate for the mezzanine floor location, but to provide an atmosphere in keeping with the firm's impeccable reputation for quality jewelry. The subdued character of the decor and the carefully planned color scheme combine to inspire confidence in the quality of the goods and services. Illumination is blended in with these appointments to display gold,

E. H. Schaefer

Milwaukee Section

This installation represented the Midwestern Region of I.E.S. at the National Technical Conference in the contest for "My Most Interesting Lighting Job," having won the first prize in the Milwaukee Section and Midwestern Region. Mr. Schaefer is a Lighting Engineer with the Special Services Sales Division of Wisconsin Electric Power Co., in Milwaukee.

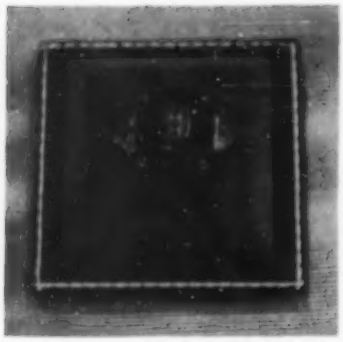


Figure 2. Faulty lighting ruins appearance of $9,000 gem.

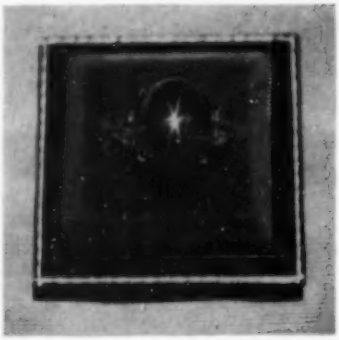


Figure 3. Proper lighting honestly shows delineation, clarity and depth of color.

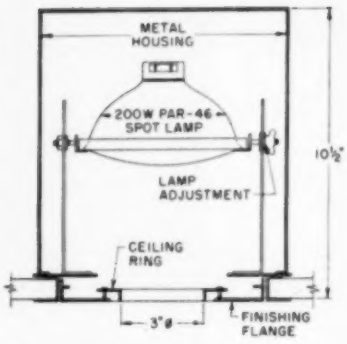


Figure 4. The light that is "kind" to a star sapphire.

silver and precious stones in the most favorable setting.

Lighting for the main store area is from baffle-type downlights recessed in the 14-foot ceiling. Closely-spaced 150-watt PAR spot lamps provide 100 footcandles at the point of sale. These are located at the outside edge of the counters so as to eliminate reflected counter top glare for the customer. Wider spaced 150-watt PAR flood lamps provide 30 footcandles of general lighting.

All wall and counter cases have in-built lighting which, coupled with the functionally placed accent units, provide maximum intensity at point of sale. Three special bronze display cabinets along one side of the room have illumination by optical train recessed units with framing shutters. This confines the lighting to the cabinet displays so as not to distract from the high level jewelry counter lighting. Illumination is controlled and actually limited to the bronze jewel case, and the 40 footcandles provided is not competitive with the 100 footcandles at point of purchase.

Flatware display counters are lighted to 100 footcandles by both incandescent and fluorescent sources. Open front silver display shelves show the merchandise to advantage with 40 footcandles on the vertical surface. The job is done with 150-watt PAR units designed for vertical illumination, and the color accents are excellent. The highlights make this a self-selling display.

Brightness is in balance in this store, as borne out by readings of 9 footlamberts for the acoustical ceiling, 7 for the draperies, 24 for the office walls, 8 for the beige carpeting and 6 for painted store walls. The illumination of vertical surfaces makes the 50-foot by 30-foot area seem larger than it actually is.

Lighting for the special sales rooms again bears in mind the owner's modest request — that it be simple, unobtrusive and that it give his gems the same honest appeal they would have outdoors. It is in these rooms that the big jewel sales are concluded and lighting characteristics are of major importance. Improper illumination can reduce the value of a gem by thousands of dollars; the clarity of the star and the depth of color is what sets the value.

The lighting system devised permitted the general lighting to be left on; recessed baffle type units for general illumination was continued in these rooms also. Supplementary sources necessary to bring out the real beauty of the gem being displayed were added to this system. An optical train with 400-watt first tried out did not achieve the results expected. While it framed the counter top as planned, it did not have enough light output to achieve the desired gem brilliance. After experimenting with numerous lighting sources, the 200-watt PAR 46 spotlamp was found to give the clarity of color sought. This lamp was recessed in the ceiling. (See Fig. 4.) Crossing of the rays 14 inches from the lamp, coupled with the elliptical character of the beam and the ceiling ring baffle provided the counter top limiting distribution desired, with 180 footcandles. Because of the high end-on candlepower of the PAR-46 lamp, the lighting effect approximated the daylight effect the jeweler wished. The selective reflections of the gems were especially good, particularly in the case of star sapphires.

Even with the limitation of black-and-white photography and the hazards of photo-engraving, the spectacular difference afforded by the proper lighting of gems is demonstrated in Figs. 2 and 3. Fig. 2 shows a $9,000 star sapphire with only general lighting. The full beauty of the gem (Fig. 3) is only apparent under light that is "kind" to it.

Low-Ceiling Store Area— A Relighting Problem

Paul A. Ducasse

Quebec Chapter

This installation represented the Canadian Region of I.E.S. at the National Technical Conference in the contest for "My Most Interesting Lighting Job," having won first prize in the contests of the Quebec Chapter and the Canadian Region. Mr. Ducasse is with Terreau & Racine, Ltee., Quebec, Que.

STRUCTURAL clutter is the lighting consultant's most persistent headache. Add to it the necessity to use standard equipment on a budget and you have the ingredients of a first-class relighting problem — or the makings of a unusual installation.

An interesting solution to these design hazards was developed for the Furniture Department of the Terreau & Racine Ltd., department store in Quebec City.

The Problem

The floor area, of 128 feet by 98 feet, had large posts every 15 feet on the long length, and every 10 feet on the other. The ceiling was only 11 feet 6 inches in height, and worse still was a veritable lattice-work of cement beams of either 18 inches or 14 inches deep. For his relighting plan the lighting consultant was presented with a ceiling cluttered with rectangles 15 feet by 10 feet, unpainted

and dirty, and unusually low for the size of the area. Suspended units, either fluorescent or incandescent, were out of the question. So was custom-made equipment.

The Solution

A custom look, however, was achieved by using the very elements of the problem in its own solution. The ceiling design was formed into 40 bays of 9 feet by 9 feet, two feet deep, each containing four rows of two 40-watt two-lamp channel type luminaries, with standard cool white fluorescent lamps. Using the ceiling and beams, painted white, as large reflectors, the bays were closed by white plastic louver tile panels. These were held in place beneath the luminaires by strap hangers, and were surrounded by a chrome molding to give a custom-made appearance. Each bay exceeds six inches from the new ceiling at 9 feet 6 inches from the floor.

For special spotlighting of specific pieces of merchandise, each post has two outlets at the top for downlights, and two at the bottom for floor lamps. Further change of pace is provided in the elevator aisle and over the information center, with louvered downlights using 150-watt concealed spotlights.

The Result

The desired result of an appearance of natural light is achieved for examination of the furniture displayed, with 70 footcandles maintained. The skylight effect of the system is pleasing in this type of shopping area.

Troop Barracks Converted To Drafting Room

MILITARY LEGEND includes the one about difficult problems being taken care of right away, the impossible taking a little longer. The job of properly lighting the Fort Sam Houston Army Post Engineers drafting room, which was itself a narrow, low-ceiling 55-foot side aisle in a converted troop barracks, just about fell into the "impossible" classification. It took a little longer, but the problem was solved in a manner satisfactory to all, including the taxpayer.

Lighting a drafting room to I.E.S. recommended practice would have been routine in a normal office building with even a modest budget. This drafting room, however, is 55 feet long and only 9 feet wide, set off in a corner of a room 80 by 30 feet, in a building originally designed for troop quarters. The ceiling height at the highest point is 8 feet 6 inches, but the outer four feet slopes down to seven feet total. The lighting assignment included "at the least possible expense."

As a cost compromise between wiring and lighting equipment, it was decided that 40-watt 48-inch T12 bare lamp strips mounted right on the ceiling would be the most economical light source. Suitable shielding of this unendurable glare, at the least possible expense, was another matter. Conventional diffusers or louvers as well as most standard fixtures, were outside of the exceptionally tight budget allowance. Goal for the installation was nevertheless 80 footcandles minimum initial illumination level, with all other characteristics as close to I.E.S. recommended practice as possible.

A rather unorthodox plywood eggcrate louver system furnished the solution. The system features three continuous rows of bare lamp strips, standard cool white 40-watt 48T-12 lamps being mounted on 2-foot 6-inch spacing. The shielding device uses three-inch strips of one-quarter-inch plywood, six inches on centers both ways. This provides a shielding angle, lengthwise with the fixtures, of approximately 30 degrees, a satisfactory condition with so low a ceiling. The bottom of the grids, or effective ceiling height, was set at six feet nine inches, allow-

Triangle-shadow is kept to a minimum with high levels of illumination.

ing a distance of one foot four inches from the louvers to the center of the lamps. This sets up the system's one defect. Lamp spacing of necessity is 2 feet 6 inches, against the I.E.S. recommended spacing with opaque louvers of not greater than 1½ to 1 times the distance from the lamps. The effect, however, is almost imperceptible.

The area above the grids was painted a flat white with a paint having a reflection factor, when new, of approximately 85 per cent. Grids were painted an off-white with a 60 per cent RF paint; the upper portions of the walls were painted with the same off-white. Lower reflection factor white for the grids was a planned part of the system, to keep the brightness of the ceiling from being objectionable at this low plane.

In spite of the "impossible" characteristics of the area, the installation devised provides well-diffused illumination on the working plane, a relatively low brightness source, and good overall illumination level, from 95 to 105 footcandles initially, with no shadows on the drafting tables. After a year's operation, with no maintenance at all, illumination dropped off to the limits of between 65 and 75 footcandles, indicating a maintenance factor of approximately 68 per cent. At these levels some few shadows can be detected on the outer edges of the tables. So few, however, that they might be considered an insignificant penalty for the liberties taken with conventional practice, especially in view of the minute fraction of conventional cost for comparable comfort.

Floyd A. Covington, Jr.

Alamo Section

This installation represented the Southwestern Region of I.E.S. at the National Technical Conference in the contest for "My Most Interesting Lighting Job," having won first prize in the contests of the Alamo Section and the Southwestern Region. Mr. Covington is Chief Design Engineer and Electrical Engineer, Post Engineers, Fort Sam Houston, Texas.

Relighting Design for The Visual Environment

MEETING I.E.S. Recommended Practice for Office Lighting was the objective in the relighting and re-decoration of the Customers' Billing Department of Public Service Electric and Gas Company, Newark, N. J. In this department, bills are prepared each month for 1,300,000 electric meter accounts and 1,040,000 gas meter accounts, with speed and accuracy most essential factors in the preparation.

The "ground rules" to be fulfilled in the lighting design were:

(1) Standard fixtures should be used so that the installation could be easily reproduced.

(2) Quality of illumination and visual comfort must be as good as that provided for many years by the indirect lighting incandescent system.

(3) Quantity of illumination in keeping with the difficult seeing tasks carried on.

(4) Total connected watts had to be reduced, to relieve the air-conditioning system.

(5) Luminaire efficiency should provide maximum footcandles with minimum wattage.

(6) Minimum glare and maximum visual comfort were mandatory, in respect to both the selection of luminaire and the use of proper reflectances for room and work surfaces.

(7) Placement of luminaires had to be integrated with the irregular physical aspects of the room architecture, for a pleasant appearance.

(8) The installation had to meet a budget.

L. T. Johnson

New York Section

This installation represented the Northeastern Region of I.E.S. at the National Technical Conference in the contest for "My Most Interesting Lighting Job," having been awarded first prize in the New York Section and the Northeastern Region. Mr. Johnson is Assistant Supervisor of Lighting Sales for the Public Service Electric and Gas Company, Newark.

Work Area and Work Surfaces

The billing department is located in a room roughly 40 by 80 feet, with three off-center columns, and associated beams and ducts, breaking the area into six different sized bays. Beams and ducts vary in depth from 12 to 54 inches; height of the acoustic tile ceiling ranges from 11 feet 4½ inches to 11 feet 7 inches.

An unusual feature of the work surfaces is that almost entirely they are on vertical surfaces. Above the curved keyboard of the billing machines is the rate chart. The meter reader's book is to the left; and, as shown in the photos, the plastic summary dial (the thin strip just to the left of the operator's forearm) is also a vertical surface.

Reflectances of the ceiling and walls were, on the whole, not bad; but much had to be done about the office equipment, particularly the billing machines which had black frames and highly specular keys.

The problem of reflected glare was approached from two directions: first, to reduce the specularity of of the offending surfaces, and second, to select the lighting system which would reduce glare to a minimum.

Graphic analyses were made of the plastic summary dial cover and the shiny keyboard. In the first case, it was found that replacing the existing curved dial cover with a flat cover would solve the problem of reflected glare.

In the case of the keyboard, the analysis proved that the 0-80° zone of the fixtures would be imaged by the keys, no matter where the fixtures were located. The best practicable solution was to dull the keys by rubbing them with fine emery cloth or using an electric eraser equipped with an abrasive material. Later, the business machine supplier came up with a special lacquer which, when applied to the keys, provides a dull finish.

New machines, purchased at the time, were of a 20 percent reflectance gray to replace the black

Before and after.

ones. New clothes lockers, files and desks, also of light gray finish, and freshly painted and covered work tables and benches assured proper reflectances from this office equipment. Ceiling, walls and woodwork were re-painted in white and light green, and glass partitions were painted in the same green wall color.

Lighting Installation

Several studies under different types of lighting at different footcandle levels soon showed that satisfactory control or reflected glare could be achieved with low brightness lamps in louvered fixtures or conventional lamps in fully-shielded units. On the basis of these findings, general lighting plans were made for seven different types of luminaires.

In each plan the design was for the minimum of the 50 footcandles illumination — specified for "difficult" seeing tasks in the Recommended Practice of Office Lighting. Each plan was also based on the maintenance program to be associated with it.

The luminaire selected was a direct-indirect, two-lamp louvered unit, with metal sides, providing 45° by 45° shielding. Ninety-six of these units, containing 40-watt T-17 low brightness lamps, are suspended approximately 16 inches from the ceiling, providing an upward component of light.

Supplementing these are a total of 23 two-lamp and four-lamp surface-mounted units, using 40-watt T-12 lamps, mounted on the bottoms of beams and ducts. In locations where reflected glare could occur, these units have hinged Albalite diffusing panel covers. At near-the-wall locations, 45° by 27° eggcrate louvers are used.

Operator at billing machine.

Calculations disclosed that with uniform spacing the number of suspended luminaires needed for the desired illumination level would be at least twice as many as good appearance would dictate. Therefore, the fixtures were installed in double row runs,

separated somewhat for maintenance. The bottoms of the suspended units are level with the surface-mounted luminaires on the beams, creating in effect a new ceiling.

Employee positions were turned about 90 degrees so that normal lines of sight are essentially parallel with the fixture runs, for maximum visual comfort.

Maintenance

Designed for an absolute minimum of 50 foot-candles, with an initial level of 85, the maintenance plan is based on:

(1) Group replacement of lamps at 80 per cent of life.

(2) Cleaning fixtures every 6⅔ months — a cycle selected to make fixture cleaning coincide with lamp replacement.

(3) Washing room surfaces every 20 months and painting them every 80 months.

Results

A resume of results shows that the new lighting system, integrated with re-decoration, fulfilled completely the ground rules originally imposed.

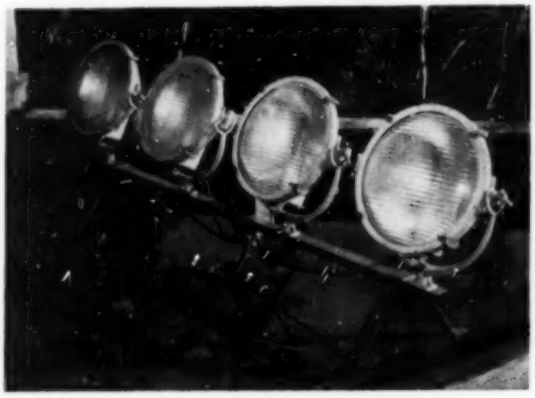
Perhaps even more striking is a comparison of production and accuracy before and after re-lighting, based on the 35 per cent of the employees (14 persons) who have continued doing the same work — a 4 per cent increase in bills prepared per hour, and a 12 per cent reduction in errors per thousand bills.

Floodlighting the California Tower

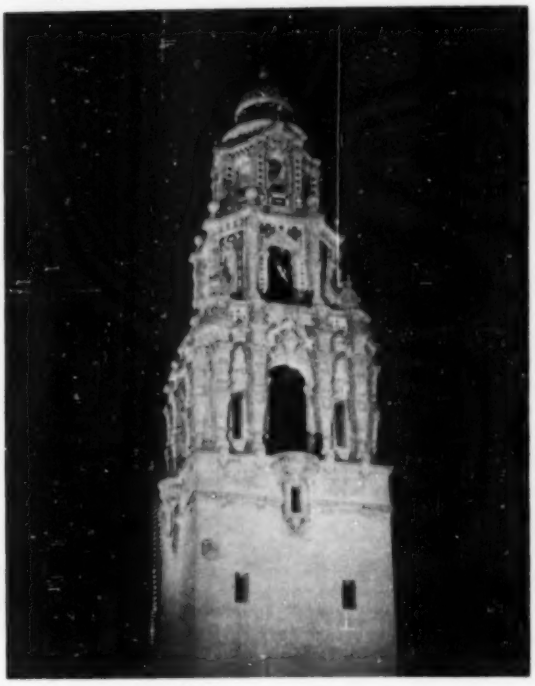
ONE COMMON denominator with most prize-winning lighting installations, however diverse the application, is a sort of "plus factor" in engineering technique. Something more is required than can be solved by the book. With the floodlighting job of the California Tower, Balboa Park, San Diego, a structural problem was turned into an asset to provide an outstandingly beautiful floodlighting installation.

Built in 1915 for the Panama-California International Exposition, the tower rose to 196 feet to the top of the weather vane — a replica of the sailing ship used by Cabrillo when he discovered the San Diego Harbor. Heavy ornamentation, recesses, open areas and columns were features of the daytime beauty of the tower. They could have been its downfall in the floodlighting installation but for the technique which used them as part of a colorful decorative pattern.

Since only the top 125 feet of the tower is visible from most parts of the city, this was the only area considered in the installation. Floodlighting units, fourteen in all, were mounted on the roof and adjoining building carefully beamed for the proper light distribution. Each was equipped with a polished Alzak reflector, adjustable mogul socket and used 1000-watt G type lamp. A beam spread of approximately 10 degrees horizontal and 38 degrees vertical, obtained with the use of a spread lens, provided a desirable light distribution pattern for the upper portion of the tower. A bank of three lights was placed on the east side of the tower, and another such bank on the west side. In



One of four banks of floodlights.



The California Tower by day ..... and by night.

addition, a bank of four lights was placed facing the southwest corner, and another facing the southeast corner in order to give cross lighting so that shadows from the heavy ornamentation work on the face of the tower would be reduced to a minimum. All floodlights in the same bank were focused on the same area to bring illumination to the required level.

The dark areas created by the window openings, unattractive in the white exterior floodlighting, were turned into assets with the use of red interior floodlighting creating a colorful contrast and preserving the Moorish design of the tower at night. Thirty-six 300-watt red reflector floodlights were used inside the tower. This number was arrived at by estimating that approximately half of the red light would be washed out by the exterior floodlighting. Sixteen of the red floodlights were located on the floor of the lower tower opening, and arranged in four banks of four lights each. They were placed in the corners of the room and directed upward so as to flood the walls and ceiling. The area of this room is 27 feet by 29 feet, with a ceiling height of 29 feet. In the second floor room, which is 22 feet by 24 feet with a 22-foot ceiling, the red lights were arranged in a similar fashion, but in four banks of three lights each. In the top room which is 17 feet by 19 feet with a ceiling 20 feet high, four banks of two lights each were used. This arrangement gave nine footcandles maintained on the surface of the tower at the lower and center openings, and very slightly less at the top opening.

Results of the coral and white floodlighting design is a tower much more beautiful by night than by day.

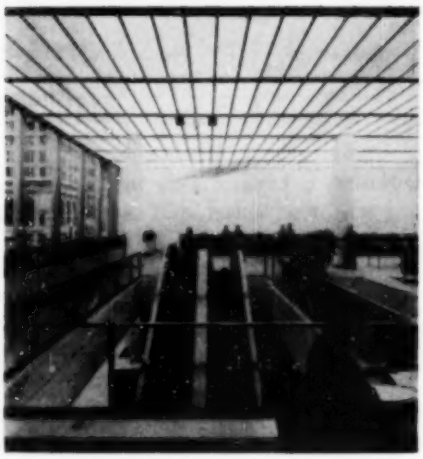
S. V. Monsees

San Diego Chapter

This installation represented the South Pacific Coast Region of I.E.S. at the National Technical Conference in the contest for "My Most Interesting Lighting Job," having won first prize in the contests of the San Diego Chapter and the South Pacific Coast Region. Mr. Monsees is City Electrical Engineer, The City of San Diego, California.

New Concept in Bank Design . . .

allows passersby a full view of banking activities, including the vault, in the new Fifth Avenue office of Manufacturers Trust Company, New York City. An important factor in the architects' "glass box" construction is the lighting — luminous ceilings throughout the structure. Their three-fold purpose serves as "display" of heroic proportions, itself a new idea in the banking world, functional illumination, and concealment of mechanical systems.



In full view of the public, the vault door (above) is a "show window item," lighted day and night with a continuation of the luminous ceiling design on the first floor. An escalator (at right) leads to the Main Banking Room on the second floor which features a similar ceiling construction and lighting system. Note the illuminated hand rails, and the sculptured metal wire hanging piece fashioned by Harry Bertoia, shown at the top of the escalator.

Quick, large volume customer banking transactions take place on the first floor, photograph at left. High level illumination (60 footcandles) over the entire area is from T12 warm tone 240 ma cold cathode fluorescent lamps mounted on 18-inch centers. Diffuser element, approximately one foot below the lamps, is corrugated vinyl plastic strips supported on a grid of aluminum T-bars suspended approximately three feet from the structural ceiling by adjustable steel straps. Aluminum plates, 10¾ inches wide and nearly 10 feet apart, run the length of the plastic ceiling in an east-west direction, concealing air-conditioning diffusers and serving to break up an otherwise monotonous expanse of uninterrupted ceiling.

All photographs by Ezra Stoller

"Everybody's Bank," the company's well-known slogan, has a literal meaning for New York's night-time scene with all-night lighting of the entire glass building. Developed by architects Skidmore, Owings & Merrill, the building involved a cantilever construction in two directions. Clear glass exterior does not support any part of the structure; it is essentially a curtain that hangs from the roof cantilevers. A second-floor set back of ten feet from the exterior wall permits a 32-foot high expanse of glass running from ground level to the third floor.

Second-floor Main Banking Room shown at left, exemplifies the wide-open look of the bank. Open teller counters have no bars or grills. Decorative highlight of this floor is the massive Bertoia sculptured bronze screen shown to the right rear. With minor exceptions, luminous ceilings are installed throughout the first and second floors. On the next two floors they are restricted to L-shaped areas bordering the Fifth Avenue and 43rd Street fronts. Remaining areas on these floors are illuminated by rows of fluorescent troffer units integrated with air conditioning diffusers.

Consulting Engineers: Syska & Hennessy
Architects: Skidmore, Owings & Merrill
Electrical Contractors: Fischbach & Moore

I.E.S. LIGHTING DATA SHEET 17-45

A.I.A. File No. 31-f

INSTALLATION AT STATE OFFICE BUILDING, CHEYENNE, WYOMING.

Lighting a Small Museum

LIGHTING OBJECTIVE: To provide general illumination for a historical exhibit in a state office building.

GENERAL INFORMATION: The walls of the area shown above (60½ x 133 feet) are gray-green burlap, the ceiling is cream and floor is black and white marbleized tile. Ceiling height in the center section is 9 feet 11 inches, and 11 feet 4½ inches at the ends.

INSTALLATION: Continuous rows of alternate Day-Brite Plexoline (97200) 8-foot luminaires (two 75-watt standard cool white) and Day-Brite 80161 150-watt incandescent units with prismatic lenses are mounted on the ceiling 10 feet apart. (The end units in each row are 4 feet long—Day-Brite 47200 with two 40-watt lamps.) The four rows in each end section run perpendicular to those in the center. The average illumination six months after installation was 40 footcandles with the following brightnesses:

glass side panels (at 45°, normal to lamps)	575 ft-L
louver (45°, parallel to lamps)	680 ft-L
Ceiling between luminaires	10.5 ft-L
Walls	11.5 ft-L
Columns (6 feet from floor)	25 ft-L
Darkest corner	6.7 ft-L

Lighting data submitted by C. D. Belt, 1921 Blake Street, Denver, Colorado, as an illustration of good lighting practice and to aid in the design of similar installations.

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Series XIX 12-54

A.I.A. File No. 31-f

Lighting for Visual Performance In a TV Set Assembly Plant

By R. M. SMART
WILLARD ALLPHIN

THE basic aims of this project were to provide a comfortable visual environment, to give interiors a pleasing appearance, to permit maximum productivity consistent with the cost of lighting, and to keep production costs at a minimum.

The last aim is particularly important on the assembly lines, because a defective chassis cannot be economically scrapped. The faulty connection, ground or short circuit must be located and repaired at considerable expense in time and effort.

Most of the lighting arrangements follow the methods outlined in the American Standard Practice of Industrial Lighting, but a separate study was made of the assembly line problem and a special luminaire was designed for its solution.

Description of Plant

The plant is located in Batavia, New York, and was designed for its present use. It replaces the TV section of an older plant in Buffalo. The main building is of single and two-story construction approximately 350 x 900 feet, with 30 x 40 foot bays.

The flat roof is supported by 40-foot spans of steel I beams with steel beams at six-foot intervals or bar-joists at four-foot intervals, normal to the main beams. Ceiling height is 16 feet and there is a 14-foot clearance to the lower flanges of the I beams.

Walls are brick and 8 x 8-foot windows have their sills 3½ feet above the floor. Metal louvered screens are used on the sides of the building which receive sunlight.

Lighting of Other Than Assembly Areas

In each case commercially available luminaires were used, according to what was believed to be sound interpretation of I.E.S. Practices.

Reception Room. — The pattern shown in Fig. 1 is formed by 32-inch square panels of corrugated vinyl plastic, giving a maintained level of 30 footcandles.

General Office. — Two-lamp general diffuse luminaires with 35° x 45° shielding and plastic side panels are suspended on 12-inch stems, from a 10-foot ceiling, as shown in Fig. 2. Rows are 10 feet apart and the maintained illumination level is 50 footcandles.

Conference Room. — Luminous plastic panels similar to those in the reception room provide 45 footcandles on the table.

Plant Office. — Here the luminaires are louvered, semi-direct, with white enameled metal side panels and two 40-watt rapid start lamps. Rows are 10 feet apart and 10 feet high. Maintained illumination is 55 footcandles.

Receiving and Shipping Departments. — Fig. 5 is typical of receiving and shipping areas, where a fairly high illumination level is desired, but where visual requirements do not require a high degree of lamp shielding. The luminaires have 8-foot, open-end white, baked enameled metal reflectors, with slots providing an upward component of approximately 10 per cent. Rows are 13⅓ feet apart and 14 feet high, providing a maintained level of 52 footcandles.

At the loading and unloading docks incandescent "trouble lamps" on reels can be carried into the trucks and freight cars, as in Fig. 6.

Parts Storage. — Here four-foot semi-direct luminaires on 12 x 12-foot centers provide 20 footcandles of illumination. See Fig. 7.

General Manufacturing Area. — Fig. 8 happens to show a tuner test section, but the lighting is typical of that used throughout the manufacturing areas for general illumination. The luminaires are louvered, semi-direct with white enameled metal side panels and two 40-watt rapid start lamps. Rows are 10 feet apart and 12 feet above the floor, providing a maintained level of 50 footcandles.

Inspection Areas. — The operation in Fig. 8 does not require additional illumination because most of the visual task involves watching wave forms

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 13-17, 1954, Atlantic City, New Jersey. AUTHORS: Sylvania Electric Products Inc., Cleveland, Ohio, and Salem, Mass.

Figure 1. Reception room has 32-inch-square panels of corrugated vinyl plastic.

Figure 2. General office maintains 50 footcandles from general diffuse luminaires.

Figure 3. Conference room has luminous plastic panels, providing 45 footcandles on table.

Figure 4. In the plant office, metal side panels make for easy maintenance.

Figure 5. Receiving and shipping departments do not require louvered luminaires, but an upward component of light is provided for good appearance.

Figure 6. At loading and unloading docks, cord reels permit incandescent lamps to be carried right into the trucks and freight cars.

Figure 7. Parts storage areas need less illumination.

Figure 8. At tuner test position the visual task is the scrutiny of wave forms on the cathode ray oscilloscopes.

on the cathode ray oscilloscope. Where more typical visual inspections are made, the same luminaires are used in rows eight feet apart, providing approximately 70 footcandles.

Warehouse. — Two-lamp slotted industrial luminaires on 10 x 10-foot centers and 15 feet above the floor provide a maintained illumination of 28 footcandles.

Cafeteria. — This is actually a multi-purpose room, being used for meetings and social gatherings as well as for dining. For this reason illumination levels of 18, 27 and 45 footcandles are available in the general area.

Each eight-foot square coffer shown in Fig. 10 has nine 32-inch square panels of corrugated vinyl plastic, the panels being separately removable for easy maintenance. In each coffer are five eight-foot strip luminaires, switched three and two.

Continuous two-lamp troffers with ribbed Albalite shielding are used over steam tables and counters to provide an illumination of 60 footcandles.

Assembly Lines

This portion of the project was given intensive study because of the special visual problems introduced by the assembly of TV chassis. In this work the physical task consists of picking up a part such as a resistor or condenser from a bin, inserting the connecting wires through the proper holes in the terminal lugs of tube sockets or connection blocks, and soldering the connections with a soldering iron.

Figure 9. Luminaires are more widely spaced in the warehouse.

Figure 10. The cafeteria is a multi-purpose room, and has three illumination levels available, besides that at the counters.

Figure 11. An assembly line in the old plant.

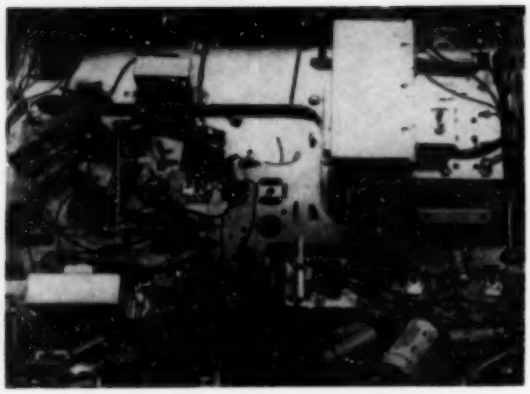

Figure 12. TV chassis under old lighting.

The visual task involves seeing the hole through which the wire must go, guiding the insertion of the wire, guiding the point of the soldering iron, and seeing that short circuits or grounds have not been established.

The visual task differs from those of fine assembly work in most other industries because it is seen against an immediate background of the bright, cadmium-plated chassis. The surface is rather specular and, being tilted toward the operator for ease of assembly, reflects somewhat diffused images of the overhead light sources.

A more common example of a fine assembly task in the electronics industry involves manipulating and welding very fine wires for miniature tubes, transistors and the like, where the immediate surround is a bench top or the base of a welding machine, and can be manipulated in regard to reflectance and specularity. With the TV set chassis, however, this control of the situation is not possible. Therefore the lighting must bear the full brunt of providing the optimum visual situation.

The assembly plant previously used for this work had overhead lighting from open non-shielded industrial luminaires, as in Fig. 11. This produced a band of reflected brightness across the chassis, as shown in Fig. 12. Thus a connection seen against the bright band appeared in silhouette, while one seen against a darker area was visible by direct lighting. The brightness of the reflection in the chassis was such as to be uncomfortable to many people. Since a reflection in the chassis could not be avoided, the problem was seen as one of spreading the reflection and minimizing its brightness, while providing a high level of illumination.

With these points in mind, the luminaire shown in Fig. 13 was designed. This luminaire consists of two continuous rows of dual 90-watt open end industrial units mounted side by side and shielded by a continuous row of 32-inch square sections of white diffusing corrugated vinyl plastic. Corrugations are normal to the lamps for greatest brightness uniformity. The shielding is mounted approximately two inches below the reflectors and 54 inches above the center of the average chassis, and centered above the chassis centers. The module sections are mounted so that any one section can be lifted and slid over an adjacent section for lamp maintenance, or the panels can be removed readily for cleaning.

Subject to the limitations of black and white, planar photography, Fig. 14 gives some idea of the quality of the illumination. Initial brightness of the plastic panels was 800 footlamberts.

As will be seen in Figs. 13 and 15, the general

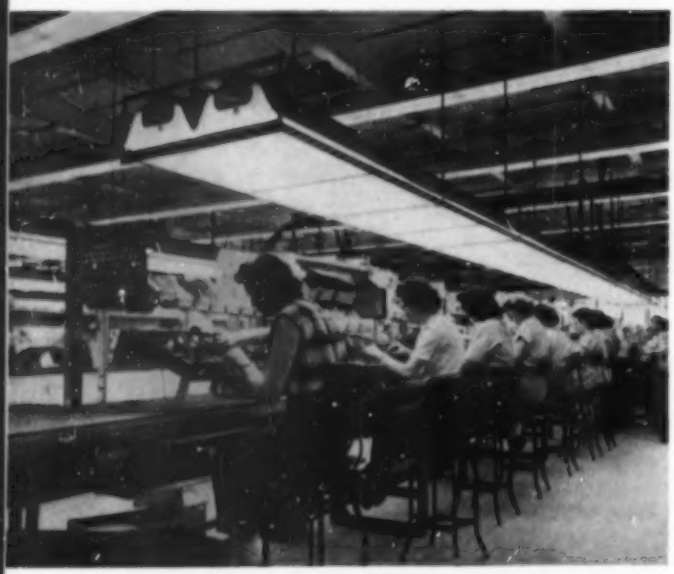

Figure 13. An assembly line in the Batavia plant.

Figure 14. High-level diffuse lighting for the new assembly lines.

Figure 15. General lighting is continued over the assembly areas.

manufacturing area lighting from continuous rows of louvered luminaires is continued over the assembly lines, even though they have their own lighting. Thus, every effort has been made to provide a comfortable visual environment by keeping the upper part of the room well illuminated.

Fig. 16 shows a chassis as seen on an assembly line in the new plant.

Results of New Assembly Line Lighting

Basic measurements and ratios are given in Table I. The new values will diminish somewhat in service, but the ratios should not change materially. Note the improvement in the ratio *D:E*, which means that the brightness adaptation of the eye goes through a much smaller range of changes as fixation shifts from one part of the chassis to another.

Conclusion

In the areas used for other than assembly purposes it scarcely seems necessary today to defend the use of illumination for factory work having as high quality as illumination for office work. This installation merely serves to confirm to Management the desirability of such an approach.

On the assembly lines it would be helpful if productivity and spoilage in the new plant could be compared with the old. Unfortunately, this would not be meaningful, because only a few supervisors were moved from the old plant to the new, and all of the workers on the lines are new employees.

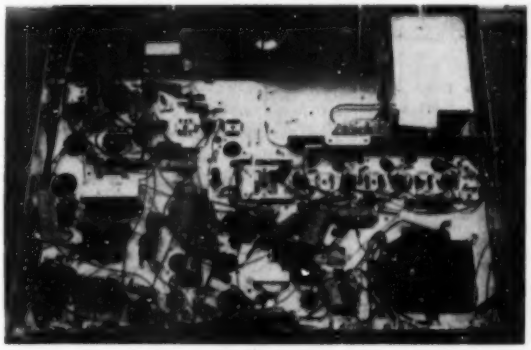

Figure 16. TV chassis under the new lighting.

TABLE I.

	Old	New
A—Horizontal illumination	36	240 Ft-c
B—Vertical illumination	5.5	74 Ft-c
Ratio *A:B*	6.5:1	3.3:1
C—Illumination at angle of chassis	30	228 Ft-c
D—Brightest reflection in chassis	200	195 Ft- L
E—Darkest area in chassis	10	55 Ft-L
Ratio *D:E*	20:1	3.6:1
Ratio *D:C*	6.7:1	0.9:1

However, those staff members and supervisors who have served in both plants are enthusiastic about the new lighting and feel that it will justify itself in high production, low spoilage and a high level of morale.

DISCUSSION

GEORGE J. TAYLOR*: This paper "describes" every phase of operation in a TV assembly plant from office to production areas. The title, however, would lead one to believe that more explicit and detailed information on TV assembly would be covered. The "subject" could have been much more valuable to plant officials if the authors would have omitted the non-productive areas and confined their description of and publication space to visual performance in the assembly departments.

The paper is a short, simple, practical application story. Actually it is too short to express some of the interesting facts in the assembly area that might have been discussed. For instance, the location of the large area low brightness units appear to be uniquely positioned with respect to operators. The storage bins in front of operators appear to act as good shielding barriers in eliminating brightness in the line of vision from overhead luminaires. With shielded overhead luminaires, good uplighting and good interior finishes the overall brightness ratio seems to conform to the American Standard for Industrial Lighting. These and other "quality" features would undoubtedly be of great interest to production men.

The fact that high levels of illumination are used and that a few brightness values are given at specific visual points does not necessarily indicate comfortable seeing conditions. The excellent 3-D slides that were shown at the conference did nevertheless illustrate that the assembly area was well lighted and comfortable. Some additional stress might have been given to the comfort angle to prove the value of good lighting to employees and benefits to owners. In this connection the last paragraph is weakly stated where staff members and supervisors only "feel" that the new lighting is justifiable. Many organizations whose interests do not lie in the manufacture of lamps or lighting equipment may wish to know more about beneficial returns before they would invest the kind of money for a lighting system such as described.

JOHN J. NEIDHART**: The authors of this paper have shown us some excellent examples of the good, practical lighting installations that can result when I.E.S. Recommended Practices are followed or bettered. There are, however, a few incongruent features which do not seem to be in keeping with the general excellence of the lighting installations.

The first point which I would like to question is the orientation of the luminous-sided luminaires in the right hand portion of Fig. 2. Although it is impossible to determine whether or not this installation is comfortable by studying the photograph, it appears that a greater degree of comfort would result if these luminaires were so oriented that they would be viewed endwise by the majority of the room occupants instead of crosswise as shown.

The second minor point that surprised me a little was the use of baked-enameled rather than porcelain enameled industrial reflectors in the receiving and shipping areas. I do not propose to discuss the merits of either finish; both are excellent for many applications. I have noted, however, that porcelain enamel is generally preferred for its greater durability in industrial applications whereas baked-enamel is usually selected for economic reasons. The general high caliber of the lighting in this plant seems to place it above such small economic differences. In fact, economies could have been effected, if desired, by designing for a somewhat lower illumination level in this area. The 52-footcandle level is noteworthy, but it seems a little hard to justify a level that is 2½ times the current recommended practice when one considers the large size and casual nature of the visual tasks. It is particularly hard to justify when one compares it with the similar level provided in the General Manufacturing Area or with the 20-footcandle level provided in the Parts Storage Area where smaller parts must be handled or identified. The actual loading and unloading docks seem to have suffered somewhat from the inherent drop-off in illumination near the ends of continuous rows, and I would rather see some of the luminaires omitted from the general receiving and shipping area, if necessary, so they could be used to better advantage over these docks.

In describing the objections to the old lighting shown by Fig. 12, the authors state that "the problem was seen as one of spreading the reflection and minimizing its brightness while providing a high level of illumination." Their success in spreading the brightness over a larger area is attested by Fig. 16 which only partially shows the tremendous improvement that was illustrated so much better by the 3-D slides used in the actual presentation of this paper. After reading the above quoted objectives, however, I was surprised to find Table I showing that the brightness of the brightest reflection was virtually unchanged (from 200 to 195 footlamberts). Recognizing that any reduction in this reflected brightness would probably also result in decreased illumination, I would like to ask the authors if they experimented at all with other combinations of brightness and illumination. Obviously, there is a point of diminishing returns where the benefits of high illumination are more than offset by too high a brightness. I am not sure which side of this point this installation is on, but I suspect that the reflected brightness is pretty near the maximum desirable — possibly even a little bit beyond it. Nevertheless, the extensive use of these specially fabricated, large area luminaires in this assembly plant represents a milestone in industrial lighting practice, and I hope we see this type of lighting gaining in use and acceptance in the near future.

DOMINA EBERLE SPENCER*: The paper by Mr. Smart and Mr. Allphin is particularly praiseworthy in two respects.

(1) In the first place, the authors did not declare their task completed when they had satisfied the requirements of the American Standard Practice for Industrial Lighting. They have gone beyond current practice, to install, in some cases, not the lighting considered acceptable today, but the lighting of tomorrow.

(2) In the second place they have shown how the simple 3:1 criterion can be used in the practical design of industrial lighting. With large luminous panels over the critical assembly line, the helios ratios most often encountered by the workers have been reduced to satisfactory levels. Although the 3:1 adaptation helios ratio is not satisfied for all lines of sight, the resulting luminous environment is a tremendous improvement over the usual practice in industrial lighting.

As a sequel to this paper, it is my hope that the authors will extend their future lighting designs in such a way that the adaptation helios ratio criteria are applied to a wider variety of lines of sight and so that data on the helios distribution is given for all rooms.

R. M. SMART and WILLARD ALLPHIN**: Most of Mr. Taylor's comments involve personal differences of opinion on the

*Day-Brite Lighting, Inc., New York, N. Y.
**Westinghouse Electric Corp., Cleveland, Ohio.

*University of Connecticut, Storrs, Conn.
**Authors.

proper way to treat the information given in the paper. However, there are two points which would seem to call for comment.

We did not attempt to give "comfort" ratings to the old and new installations because there is no system officially recognized by the I.E.S. for scientifically evaluating comfort.

From a common sense standpoint it is clear to anyone visiting the plants, and probably evident even from the photos and ratios, that the new installation is more "comfortable" than the old.

We are at a loss to see how Mr. Taylor's last point can be met. Not only was the whole physical environment improved along with the lighting, but the workers on the assembly line at Batavia are all new to the job. Until such time as the new workers have had sufficient training, comparative production data between the old and new plants were felt to be of little value.

With or without storage bins in front of the operators, the brightness in the line of vision from overhead luminaires would be within the limits of the American Standard for Industrial Lighting, because the direct-indirect louvered luminaires and surround finishes were selected to accomplish this objective.

In reply to Mr. Neidhart's first point, it is our experience that modern office seating arrangements are so flexible that no luminaire should be used which is unduly bright from any normal viewing angle either sidewise or endwise. Even in offices where desks are arranged in regular rows facing the same direction, typists often turn sidewise to use the typewriters.

It might be added that the luminaires in question are not uncomfortable whether viewed sidewise or endwise.

It seems to the authors that the porcelain versus baked synthetic enamel controversy has had considerable "airing" in the past and we do not agreed that there is any universal preference for porcelain enamel in industrial applications. To answer Mr. Neidhart's specific question, we believe that the lower cost of high quality baked synthetic enamel is justified, particularly since there are no indications that atmospheric conditions in the plant might have a deleterious effect on such a finish.

The receiving and shipping areas, we feel, merit a relatively high illumination level because, while the merchandise involved is relatively large in physical dimensions, the labels denoting the contents and/or the destination of the cases are in relatively small print. An error in reading the labels can be costly in incorrect appraisal of available inventory, in incorrect selection of merchandise to fill an order and/or in misdirection of the merchandise on an order (Springfield, Illinois would be very unsatisfactory had Springfield Ohio been indicated on the label). The lower levels in the live storage areas are justified, we feel, because the parts are selected by size and form (a much less severe seeing task) rather than by what might be seen on a printed label.

Answering Mr. Neidhart's questions on brightness, experiments were conducted with different brightnesses and luminaire designs before the present system was chosen. While it is true that the brightest reflection diminished only slightly, the brightness of the darkest area increased 5½ times, as indicated in Table I.

At the same time, the illumination at the angle of the chassis increased 7½ times.

Thus the adaptation brightness of the eye is increasing markedly while the brightest reflection is decreasing slightly.

As to whether there is anything inherently uncomfortable in a brightness of 200 footlamberts, we have only to ask ourselves whether it would be uncomfortably bright under outdoor conditions. We feel that the answer is definitely "no."

The authors thank Dr. Spencer for her comments and are pleased to know that such practical applications further confirm the groundwork laid by Dr. Spencer and others.

Some Problems Involved in the Design of Fluorescent Lamps

Discussion of paper by E. F. Lowry, W. C. Gungle and C. W. Jerome

(Published November 1954 ILLUMINATING ENGINEERING)

GORDON HARVEY*: This very interesting paper prompts me to ask two questions:

1. If the equation for efficiency were extended to include the ballast with the lamp, would the expression of $19I$ for electrode loss apply equally for rapid start and instant start, and would all of the separate cathode heating watts have to be added as an additional expression?
2. Would it not be possible for lamp manufacturers to provide ambient vs OCV requirements, perhaps in ASA C78 specifications, on this and other lamps that are likely to be used out of doors?

*General Electric Co., Danville, Ill.

C. L. AMICK*: This paper certainly reports excellent work, perhaps the most significant of which is the performance information on high-brightness fluorescent lamps filled with 50-50 mixtures of argon and krypton. Such data, combined with the new and much better understanding of starting phenomena, should lead to the development of more efficient lamps than previously available.

A few brief comments and questions:

(1) Regarding Fig. 1, our experience shows that maximum efficiency rises slightly as bulb diameters are decreased from T-12 to T-5, with declining maximum efficien-

*General Electric Co., Cleveland, Ohio.

cy for bulbs larger than T-12. The relatively small efficiency differences reported in this paper may be caused by comparing lamps of different lengths. Had common lengths been used, 96 inches for example, the slope of curve A would have been considerably different. From a practical standpoint, we agree with the authors' conclusion that a 1½-inch diameter best combines the merits of high efficiency and high light output.

(2) With regard to the discussion on lower filling pressure (page 547), our data are in agreement concerning lumen maintenance. However, our tests show that lower pressures always produce shorter lamp life, other things being equal.

G. M. Marks*: Allow me to take this opportunity to express my personal appreciation and congratulations to the authors for this paper. It is papers like these presented this morning that have enabled us to move to our Diamond Jubilee with great pride in the past and an optimistic look to the future.

In looking over the paper one question came to my mind regarding Fig. 1. The only lamps listed are those commercially available, the T5, T8, T12 and T17. Are we limiting our thinking by not analyzing the efficiency of lamps between the T12 and T17 lamps such as a T14 or T15 or is there fairly accurate data that proves the T12 is the most efficient lamp with regard to diameter?

T. H. Heine**: The authors have taken us step by step through some of the various studies necessary in the development of a new fluorescent lamp designed for high current loading. One point that cannot be over emphasized when considering the use of such highly loaded fluorescent lamps is the need for well ventilated fixtures. Not only is the lamp efficiency lowered as shown in Fig. 7 but also the lamp wattage is reduced due to the lower operating voltage of the overheated lamp. Lowered efficiency at reduced wattage of course results in a substantial decrease in total light output.

In the case of the 40-watt T-12 argon lamp, a bulb wall temperature rise of 35°F above the bare lamp temperature decreases the lamp voltage as much as 15 volts and the wattage by 6 watts. Efficiency drops about 12 per cent and total light output is only 75 to 80 per cent of rated lumens.

This loss is less serious for the lamp design presented which uses the mixed gas that we developed for the highly loaded 90-watt T-17. Our data on the 800 to 1000 ma 96T12 lamp filled with the 50 per cent krypton 50 per cent argon mixture show that the loss in output at elevated temperatures is less than for a similar lamp filled with argon alone. However, the problem remains a serious one, and an extension of the paper to show the total output in relation to ambient temperature would be of value in emphasizing the precautions necessary.

E. F. Lowry, W. C. Gungle and C. W. Jerome†: We would like to thank the various contributors to the discussion of this paper for their favorable reception and interest shown in this work.

The expression, $19I$, for the cathode loss inquired about by Mr. Harvey, applies strictly only to preheat lamps. The expressions for instant start and rapid start lamps will be very slightly different because of the different constructions of those cathodes. That is, they will require slightly different amounts of power to heat. However, these differences should be very small possibly no more than differences between individual lamps of the same type. Some experiments we have performed with rapid start lamps indicate that the power required by the cathode is determined by the current at which the lamp is operated. If less power than required is supplied by external means, then the balance is taken from the arc so that the overall power heating the cathode remains essentially constant. In other words, it apparently makes no difference in overall power consumption of the lamp whether the power to heat the cathode is supplied by the arc or by an external winding on the ballast. However, any excess power supplied to the cathode by external means is wasted and results in lower overall efficiency.

It has been brought out before and it is well to re-emphasize the importance of open circuit voltage requirements for lamps for outdoor use. As the ambient temperature goes down the starting voltage goes up as shown in Fig. 4 for the 72T12, 1.0 ampere, rapid start lamp. Tests of this new lamp indicate that their behavior is qualitatively the same. That is, a decrease in ambient temperature which will cause a 10 per cent rise in starting voltage in one case, will also cause a 10 per cent rise in the other.

The lamps chosen for the data of Fig. 1 all have nearly the same lamp voltage. This parameter was chosen to be held constant in order to keep the cathode losses a constant percentage of the total power. Therefore, the data shown indicate the effect of bulb diameter on arc efficiency. If some other parameter is held constant, such as lamp length, then a somewhat different curve will result. However, our experience does not agree with that of Mr. Amick. For example, our 96T8 lamp is slightly less efficient than the 96T12 in spite of its lower percentage cathode loss. The present results are in agreement with previously published data. (See Fig. 2 of Reference 1.)

As stated in the paper, our experience confirms Mr. Amick's comment on the effect of pressure on lamp life. However, as pointed out, krypton gives greater protection to the cathode and improvements in cathode design and the use of zirconia additions to the coating have increased cathode life such that these lamps should give quite satisfactory operating lives even at low gas pressure. With the present long life of fluorescent lamps, insufficient time has elapsed to obtain the complete life picture of this new lamp. However, to date, there have been no results which would indicate any serious decrease in its life.

In answer to Mr. Marks' question, we have no data on sizes between T12 and T17. However, all our experience indicates that the T12 bulb gives very close to the maximum efficiency. Because of the inflection in the curve near this point, any slight variation in bulb diameter will have only a slight effect on efficiency.

We are in hearty agreement with Mr. Heine's remarks concerning the need for well ventilated fixtures for highly loaded fluorescent lamps. As stated in the paper, this point cannot be emphasized too strongly. If the effect of ambient temperature on total light output is desired, the data in Fig. 7 can be taken as a close approximation. Since the effect of temperature on power is small compared to that on total light output, the light output curve will follow the efficiency curve very closely.

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Economics of Mercury Lighting For Industrial Areas

By W. H. JOHNSON
W. H. KAHLER
D. W. ROWTEN

MERCURY LIGHTING is now being used extensively in industry because of its many favorable characteristics. The economics, electrical and illumination characteristics of mercury lighting, however, are different from other sources. Therefore, this paper has been prepared to provide guideposts for the lighting system designer.

The family of mercury lamps now covers a wide range of wattages and types to meet the variety of layout requirements. Table I lists the up-to-date characteristics of the mercury lamps now used for general lighting.

Economic Analysis

A true appraisal of the economics of a lighting system should include consideration of both initial and operating costs. Therefore, a cost of light analysis is generally computed on an annual basis including fixed charges (depreciation, interest, taxes and insurance) plus operating charges. The analysis in this paper is based on 10 per cent for depreciation and 5 per cent for interest, taxes and insurance.

In most cost analyses the initial cost of lighting equipment can be estimated with a fair accuracy but the initial cost of labor and wiring materials is more difficult to estimate because wiring details are not worked out and job conditions vary widely. In this study the wiring was planned in detail and the labor was computed from Sherlock's Bluebook of Electrical Estimating. Therefore, the overall initial cost in this analysis can be considered fairly representative of average conditions.

All of the lighting systems in this analysis were planned for a typical high bay industrial area of 30,000 sq. ft. with a room index of E and a 40-foot mounting height. Maintained illumination is 50 footcandles, power rate 1c per kilowatt hour, and systems will operate 4000 hours per year.

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 13-17, 1954, Atlantic City, New Jersey. AUTHORS: Westinghouse Electric Corp., Cleveland, Ohio.

Initial Cost

In planning the wiring, the economics of various branch circuit sizes was questioned by making a preliminary analysis of 20-ampere *vs.* 50-ampere circuits. This preliminary analysis was made for the 400-watt E-H1 mercury luminaires operating from 120-, 265-, and 460-volt power supplies. Fig. 1 illustrates the relative economy of 20- *vs.* 50-ampere circuits and the study indicates very little difference between the two sizes of circuits regardless of power supply voltage. Therefore, 20-ampere branch circuits were selected for greater flexibility in wiring layout and for easier installation of the smaller size circuit conductors.

Lighting layouts were designed for 400-watt E-H1, 700-watt A-H18, 1000-watt A-H15, 1000-watt A-H12 and 3000-watt A-H9 mercury lamps, 90-watt T-17 fluorescent lamps, and 1000-watt PS-52 incandescent lamps. The 400-watt A-H1 lamp was not included because the more efficient E-H1 lamp has practically superseded the A-H1. Reflector lamps are not included because previous studies indicate no saving over conventional reflectors and lamps. Wiring was designed for 120-, 265- and 460-volt supply to all systems except the incandescent which was planned for only 120 volts. Feeders are 120/208 volt, 3-phase 4-wire for the 120-volt equipment and 265/460 volt 3-phase 4-wire for 265-volt and 460-volt equipment.

Fig. 2 illustrates by bar diagrams the economy of the initial installation cost of these various systems. The following major conclusions concerning initial cost can be taken from Fig. 2.

(1) The fluorescent systems have the highest initial cost due to the great number of luminaires required. The lower coefficient of utilization for the wide spread fluorescent luminaires tends to increase initial cost.

(2) The high wattage mercury systems have the lowest initial cost because a minimum number of luminaires are required.

(3) Wiring costs can be reduced approximately 30 per cent by going from 120- to 265-volt power

TABLE I.—Principal Mercury Lamps for Interior Lighting.

Type	A-H1	E-H1	J-H1*	K-H1**	L-H1***	A-H18	B-H18*	A-H15	B-H15*	A-H12	C-H12*	A-H9
Watts (Lamp only)	400	400	400	400	400	700	700	1000	1000	1000	1000	3000
Rated Initial Lumens	15,000	20,000	19,000	17,000	16,000	35,000	33,000	53,000	50,000	55,000	52,000	120,000
Rated Average Life at 5 Hrs. per Start	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	5000
Outer Bulb	BT-24	BT-37	BT-37	R-57 I.F.	R-57 I.F.	BT-46	BT-46	BT-56	BT-56	BT-56	BT-56	T-9½
Outer Bulb Finish	Clear	Clear	Ph Co	Slv Ref	Slv Ref	Clear	Ph Co	Clear	Ph Co	Clear	Ph Co	Clear
Burning Position	Vert	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any	Any
Arc Length (In. Nominal)	6¼	2¾	2¾	—	—	5	5	6	6	5	5	48
Base	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	Mog Sc	SCterm
Max. Overall Length	13	11½	11½	12¾	12¾	14½	14½	15⅝	15⅝	15⅝	15⅝	54⅞
Aver. Light Center (inches)	7⅝	7	7	—	—	9½	9½	9½	9¼	9½	9½	—
Open Circuit Volts	230	230	230	220	220	460	460	460	460	220	220	850
Operating Volts (approx.)	135	135	135	135	135	265	265	265	265	135	135	535
Operating Current (amps. approx.)	3.2	3.2	3.2	3.2	3.2	2.8	2.8	4	4	8.2	8.2	6.1
Starting Current (amps. approx.)	5	5	5	5	5	5	5	6	6	12	12	9.3
Starting Time (minutes)	7	4	4	4	4	4	4	4	4	4	4	7

*Fluorescent Mercury Lamps (color-corrected).

**Wide Beam.

***Medium Beam.

supplies. However, by supplying lighting from the 460-volt phase to phase power supply, there is very little reduction in cost over the 265-volt supply from phase to neutral.

(4) Lighting equipment costs can be reduced by using higher voltage power supply only when a lower cost ballast can be used. In the case of systems 6, 9 and 11, a reactor type of ballast is used rather than an auto-transformer type and the reactor type ballast has a lower cost.

Annual Cost of Lighting

The bar diagram in Fig. 4 illustrates the economy of these various lighting systems on an annual cost of light basis. The following main points can be concluded from this analysis:

(1) The fluorescent and incandescent systems have approximately the same annual costs but are considerably higher than any of the mercury systems. The high cost of the fluorescent system is caused by high initial cost and high maintenance cost. The high annual cost of the incandescent system results from the high cost of power due to the lower efficiency of the incandescent lamp.

(2) High wattage mercury lamps have the lowest overall cost.

(3) Higher distribution voltages for lighting reduce the overall cost.

(4) Where the distribution system is 265/460 volt 4-wire 3-phase the 1000-watt A-H12 mercury lamp is most economical because a reactor type ballast can be used from the 265-volt phase to neutral power supply.

(5) Where it is desirable to use the phase to phase 460 volts, the 1000-watt A-H15 lamp is most

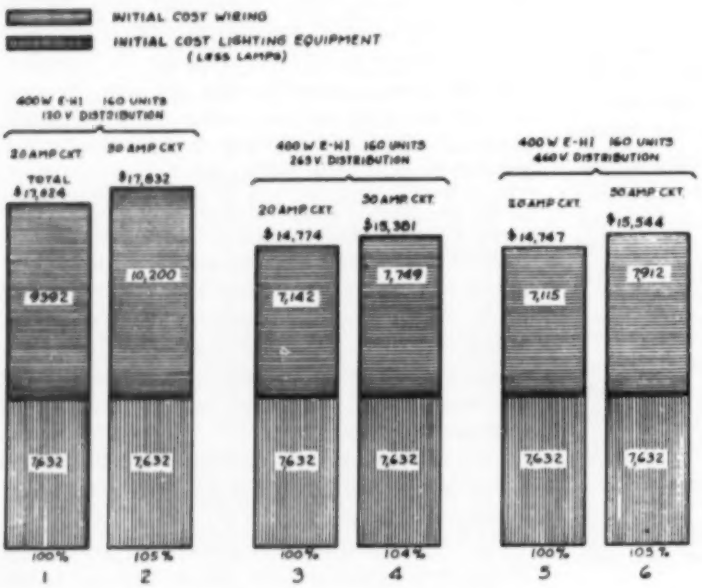

Figure 1. Branch circuit cost analysis, 20-amp vs. 50 amp circuits.

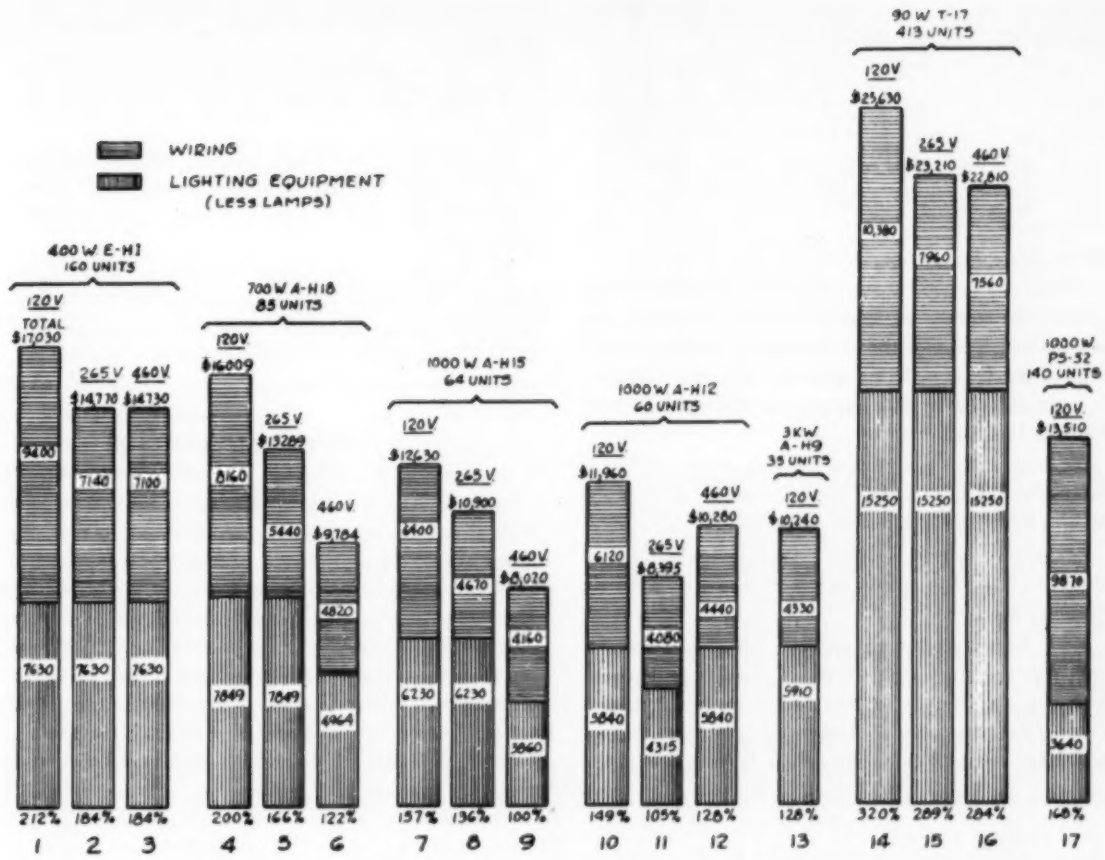

Figure 2. Initial cost of lighting — high-bay industrial area, 30,000 square feet, 40-foot mounting height, 50 footcandles.

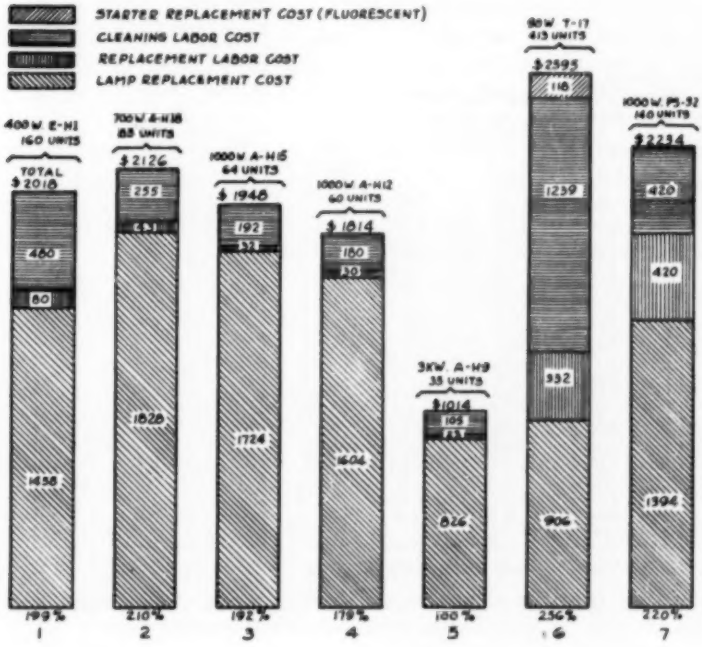

Figure 3. Lighting maintenance costs, high-bay industrial area, 30,000 square feet, 40-foot mounting height, 50 footcandles.

economical because a reactor type ballast can be used on the 460-volt supply.

(6) System 13 — 3000-watt A-H9 mercury — has low initial cost and low maintenance cost but power cost is high resulting from the lower efficiency of this particular mercury lamp. Therefore, overall cost is slightly higher than 1000-watt mercury.

Maintenance Economics

The economics of the maintenance of the lighting system is very important because maintenance should be given constant attention to retain overall efficiency of the lighting system. Fig. 3 illustrates by bar diagrams the maintenance costs of these various lighting systems.

The cost of maintenance in this study includes lamp renewals, labor to replace lamps, and labor to clean the luminaires at six-month intervals.

This breakdown of maintenance costs emphasizes several important points in the economy of lighting maintenance.

(1) For high lumen sources (mercury and incandescent) the actual cost of the lamp replacements is by far the largest factor in maintenance cost. Cleaning cost is relatively low and should therefore be practiced on schedule to permit the other more expensive items to function most efficiently.

(2) In the fluorescent system cleaning cost is a very large factor because so many luminaires are included.

(3) As would be expected, the cost of maintenance is least for the minimum number of units. Therefore, the 3 kw mercury has lowest maintenance cost.

All of the mercury and incandescent systems employ ventilated high bay aluminum reflectors, except the 3 kw mercury. The fluorescent systems employ ventilated reflectors which are slotted on the top for approximately 7 per cent upward component of light.

Mercury Lighting Different from Other Sources

Mercury lamps have different characteristics from other general lighting sources and, therefore, the designer of equipment and systems must specifically consider these characteristics to obtain the most effective and most economical use of the source. For example, the size of the light source complicates the design of a reflector and reflector contour must be adapted to this characteristic to obtain acceptable distribution shapes. Reflectors for the fluorescent mercury lamps are designed

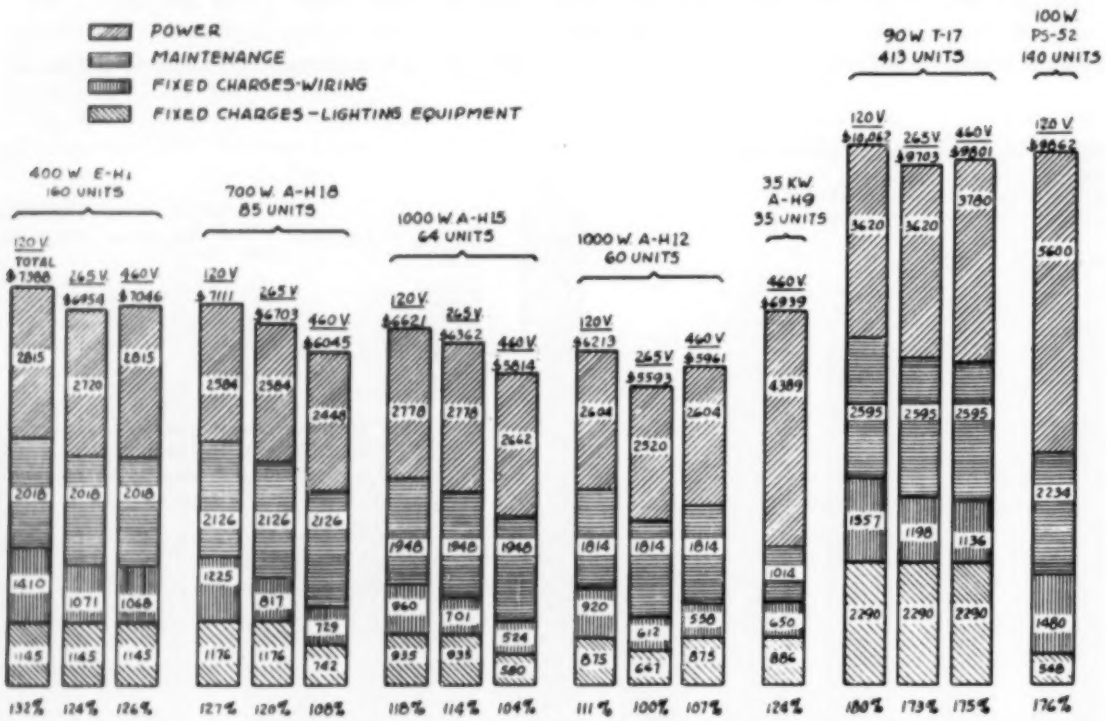

Figure 4. Cost of lighting analysis — industrial plant, 30,000 square foot, 40-foot mounting height, 50 footcandles, 4000 burning hours per year, energy rate $.01/kwh for fixed charges, branch circuits 20 amperes each.

with the size of the outer bulb considered as the light source. It has been found, that relatively good concentration of light can be obtained from these large sources if the reflector size is large enough in relation to the bulb size. In the case of the 1000-watt fluorescent mercury lamp, a 24-inch diameter reflector gives excellent control and high efficiency.

In the case of reflectors with a specular finish, the reflector contours must be such that the light from the mercury arc is not separated from the light from the outer bulb as far as reflected light is concerned. Such a color separation would result in non-uniform distribution of color on the working area.

Lighting Efficiencies

The efficiency of various lighting systems may often be compared on the basis of the lumens per watt efficiency of the light sources. This is not, however, a true comparison because the net efficiency is more closely related to the illumination delivered to the working area which is governed by the coefficient of utilization of the luminaires. The coefficient of utilization is determined by the luminaire distribution and by the overall luminaire efficiency. The data in Table II show a comparison for the lighting methods used in this analysis of source efficiency (lumens per watt), luminaire efficiencies, and utilization efficiencies (coefficients of utilization). The particular area under consideration has an E room index and reflection factors of 50 per cent for the ceiling, 30 per cent for the walls, and 14 per cent for the floor, but data are also given for C and H room indices to show the effect of room proportions. The larger mercury sources show higher coefficients of utilization because they are used in larger diameter reflectors which are more efficient. The 3000-watt mercury and the 90-watt fluorescent systems have the lowest coefficients primarily because they have wide photometric distributions.

Lighting Quality

All of the systems in this analysis do not necessarily produce the same quality of lighting, but all of the systems have been used in industrial areas with general acceptance from a quality standpoint. The 400-, 700- and 1000-watt mercury and 1000-watt incandescent lamps are well shielded by deep reflectors to minimize direct glare. The 3 kw mercury lamp has 30-degree shielding normal to the lamp, but no shielding parallel. Therefore, luminaires should be mounted at right angles to the usual direction of view for maximum comfort. The lower brightness of the fluorescent sources would give this system the best overall quality rating considering direct and reflected glare and shadows.

Power Interruption Problems

One inherent characteristic of all mercury lamps is the time delay before re-starting in the event of a power interruption. On most distribution systems today, however, power interruptions are infrequent and this is not a serious problem. However, all mercury installations should be provided with a small amount of stand-by incandescent lighting for safety to prevent total darkness if an interruption does occur. On many relighting installations the existing incandescent system has been left for this purpose. For new installations, incandescent lighting that will provide 5 to 10 per cent of the normal mercury illumination is adequate.

The Color Problem

For many years one of the objections to mercury lighting was the strong yellow-green color of this source which produces a somewhat displeasing effect on complexions and distorts other natural colors. The new fluorescent mercury lamps, however, have eliminated this objection because their color spectrum is more complete including a red

TABLE II.—Analysis of Lamp, Luminaire and Utilization Efficiencies.

	Ventilated Aluminum High Bay Reflectors									Porc. Refl. Non-Ventilated	Porc. Refl. Upward Component
Reflector Diameter	18"	18"	24"	24"	24"	24"	24"	24"	18"		
Lamp	400 W E-H1 Merc.	400 W J-H1 Fluor. Merc.	700 W A-H18 Merc.	700 W B-H18 Fluor. Merc.	1000 W A-H15 Merc.	1000 W B-H15 Fluor. Merc.	1000 W A-H12 Merc.	1000 W C-H12 Fluor. Merc.	1000 W PS-52 Inc.	3000 W A-H9 Merc.	2-90 W T-17 Fluor.
Initial Lamp Lumens	20 M	19 M	35 M	33 M	53 M	50 M	55 M	52 M	21.5 M	120 M	10.8 M
Lumens/Watt	50	47.5	50	47	52	50	55	52	21.5	40	60
Lumens/Watt Including Ballast Losses*	46.5	43.2	46	43.4	48.8	46	50.7	47.8	21.5	38.2	51.5
Reflector Efficiency	.70	.77*	.81	.74	.74	.79*	.74	.79*	.79	.80	.79
Coefficient of Utilization:											
Room Index C	.67	.74	.77	.71	.67	.74	.67	.74	.76	.68	.64
E	.63	.70	.72	.67	.61	.70	.61	.70	.71	.61	.56
H	.52	.59	.61	.56	.47	.59	.47	.59	.61	.44	.39

*Specular Reflector.

**For 120 v line except 3 kw which is 460 v line.

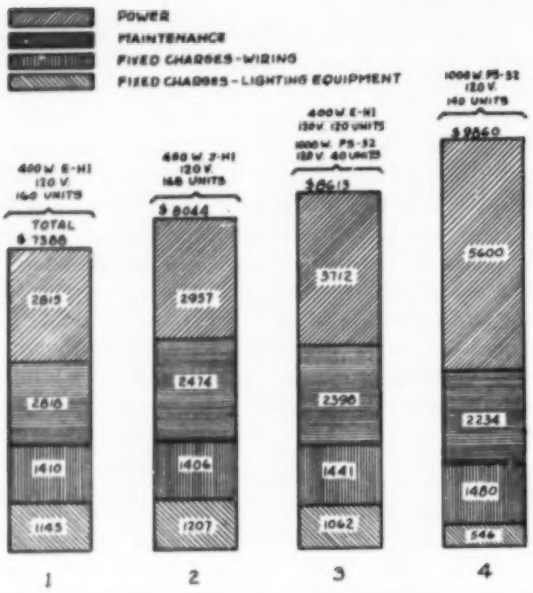

Figure 5. Economic analysis of color-corrected mercury lighting, high-bay industrial area, 30,000 square feet, 40-foot mounting height, 50 footcandles.

component. With clear mercury lamps it has been common practice to use a combination of incandescent and mercury lamps to produce an acceptable color quality. Today the fluorescent mercury lamps are being used in place of these combination systems to obtain the full advantages of the long life and higher efficiency of the mercury source. Fig. 5 illustrates the relative economy of clear mercury, fluorescent mercury, combination mercury and incandescent, and straight incandescent lighting.

The fluorescent mercury lamp color is considered to be equivalent to about 70 per cent mercury and 30 per cent incandescent lumens. Therefore, in this comparison the combination consists of three E-H1 mercury and one 1000-watt incandescent luminaires which produce approximately the 70/30 ratio of lumens delivered to the work plane.

The straight mercury lighting is, of course, the most economical because the lamps have the highest efficiency and lowest cost. However, where color is a problem, the fluorescent mercury lamp is more economical than the combination system and this fact accounts for the very wide acceptance of the fluorescent mercury lamp in industry today.

Electrical Characteristics That Affect Distribution System Design

Like all vapor lamp sources, the mercury lamp requires some type of ballast to limit the operating current and the high reactance of this ballast results in a low power factor. Therefore, practically all ballasts used with mercury lamps are provided with a capacitor to correct the power factor over 90 per cent. There are various types of ballast circuits and these have different effects on the design of the distribution system and the economy of the system. Fig. 6 illustrates the circuit of a single lamp ballast consisting of a high reactance auto-transformer and a capacitor connected across extended windings to produce power factor correction.

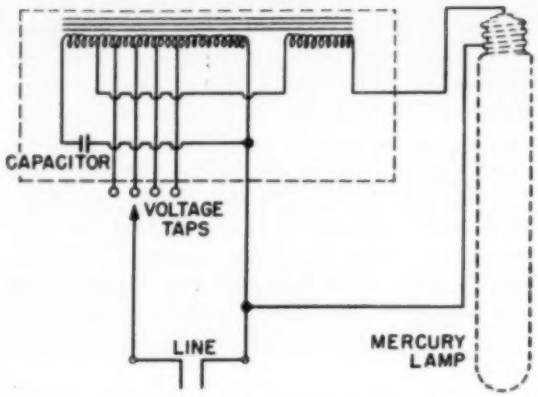

Figure 6. High reactance ballast, power factor corrected.

Where the line voltage is high enough for starting the lamp, the ballast may be a simple reactor with a capacitor across the line for power factor correction, Fig. 7. This type of ballast is used with the 1000-watt A-H15 lamp on 460-volt circuits and with the 1000-watt A-H12 lamp on 265-volt circuits. The reactor is lower in cost than the auto-transformer and thus the initial cost of the system is somewhat reduced.

High reactance ballast circuits have peculiar line current characteristics that influence the selection of circuit protective devices. When the

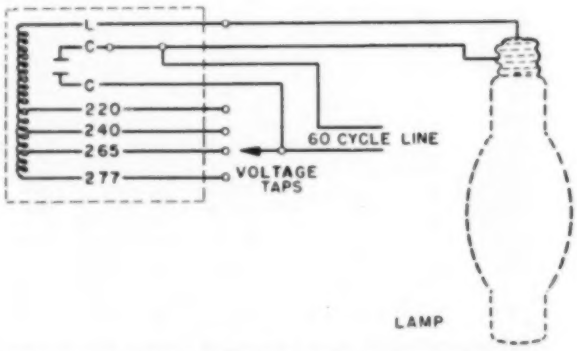

Figure 7. Reactor type ballast, power factor corrected.

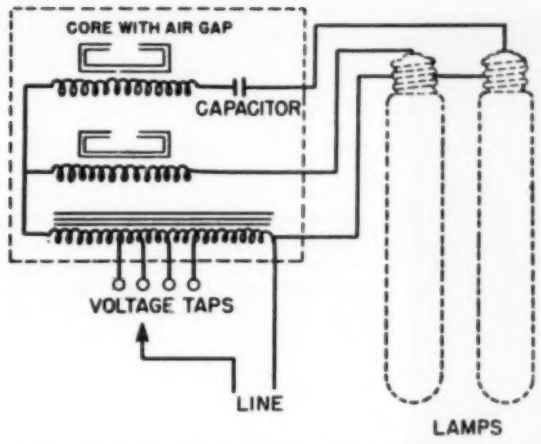

Figure 8. Two-lamp lead-lag ballast, power factor corrected.

lamp starts, line current is higher than normal, then drops gradually to normal current in about four minutes. If circuit is interrupted and then re-established, lamps will not restart until they have cooled enough for the available open circuit voltage to restrike the arc. During the "open circuit" condition, some ballasts draw more than line current. Circuit protection should be selected with consideration of these starting and open circuit currents as well as normal current.

Ballasts for operating two 400-watt mercury lamps are available and are designed on the lead-lag principle as shown in Fig. 8. This ballast circuit has a low starting current and, therefore, circuit protective devices are selected on the basis of normal operating current.

Table III tabulates the number of mercury lamps that can be operated from various size circuit breakers using the different types of mercury ballasts commercially available.

It has been found that the normal line current from mercury systems contains certain harmonics. On a normally balanced 3-phase circuit these line currents may produce considerable current in the neutral. Therefore, it is recommended that the neutral on 4-wire 3-phase systems supplying mercury lighting be the same size as the phase conductors to accommodate the current created by these harmonic currents.

Applications Best Suited to Mercury

Industrial plants are the main interior lighting applications for mercury today. The high lumen mercury lamps are only suitable for high bay areas (Figs. 9 and 10) while the lower lumen lamps such as the E-H1 can be used at medium mounting heights (Fig. 11). As a "rule of thumb," minimum mounting heights are 18 feet for E-H1 and J-H1 lamps, 25 feet for A-H18 and B-H18 lamps, 30 feet for A-H12 and A-H15 lamps and 40 feet for A-H9 lamps. These are approximate limitations, but practice indicates that direct glare will not be too objectionable at these heights if reflectors provide good shielding.

The selection between clear and fluorescent mercury is governed by the anticipated reaction from employees. There are many successful straight mercury installations without color correction. Heavy industrial applications such as foundries, steel mills, and forge shops have been found to be suitable for straight mercury. High illumination levels also tend to off-set the color objection. For assembly or finished product areas, color correction is usually required and, therefore, such areas are best

TABLE III.—Number of Mercury Lamps per Circuit Breaker.*

Lamps and Ballast Combination				Breaker Size in Amperes						
				15	20	25	30	35	40	50
Lamp	Ballast Type	Ballast O.C. Volts	Line Volts	Min. Wire Size (NEC Type RW)						
				14	12	10	10	8	8	6
E-H1 and J-H1 400-Watt	H.P.F. High Reactance	220	120	2	3	4	5	6	6	8
	H.P.F. Reactor	265	265	4	6	7	9	10	12	15
	H.P.F. High Reactance	220	460	8	13	16	20	23	26	33
	H.P.F. Lead-Lag 2-Lamp	220	120	2	2	4	6	6	8	10
A-H18 and B-H18 700-Watt	H.P.F. High Reactance	460	120	1	2	2	3	3	4	5
	H.P.F. High Reactance	460	265	3	4	5	6	7	8	10
	H.P.F. Reactor	460	460	5	7	9	11	13	15	19
A-H12 and C-H12 1000-Watt	H.P.F. High Reactance	220	120	1	1	1	2	2	2	3
	H.P.F. Reactor	265	265	1	2	3	4	4	5	6
	H.P.F. High Reactance	220	460	4	5	6	8	9	10	13
A-H15 and B-H15 1000-Watt	H.P.F. High Reactance	460	120	1	1	1	2	2	2	3
	H.P.F. High Reactance	460	265	2	3	4	5	5	6	8
	H.P.F. Reactor	460	460	4	5	7	8	10	11	14
A-H9 3 kw	Auto Transformer	850	120	—	—	—	—	—	—	1
	Auto Transformer	850	265	—	1	1	1	1	2	2
	Auto Transformer	850	460	1	1	2	2	3	3	4

*Number of lamps per circuit based on thermal breakers in panelboards with breakers loaded to approximately 70 per cent of rating.

Figure 9. The 1000-watt A-H12 mercury lamp was used in enclosed luminaires in this fabricating shop. Mounting height is 33 to 37 feet, illumination 45 footcandles.

Figure 10. In this automobile press shop, 3000-watt mercury luminaires produce 70 footcandles maintained. By using the 3000-watt lamp a minimum number of luminaires were required and maximum maintenance economy is the result.

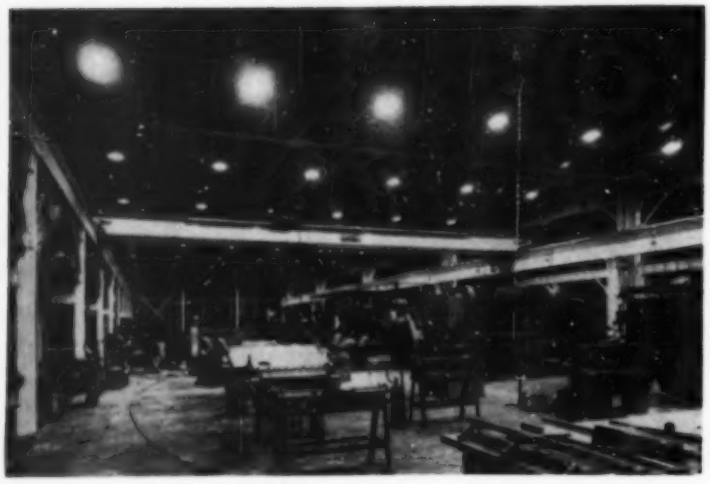

Figure 11. The Detroit Arsenal Machine Shop is a typical application of mercury lighting at medium mounting heights. J-H1 fluorescent mercury luminaires are installed on 10- to 20-foot spacings, 22-foot mounting height, and illumination is 35 footcandles maintained.

Figure 12. Commercial lighting applications of mercury lamps may become common in the future. This university library was relighted by equipping the large luminaires with 400-watt J-H1 fluorescent mercury lamps. The color, illumination quality and improved illumination levels have made this a very acceptable mercury lighting installation.

suited for fluorescent mercury lamps. This requirement is probably related to a worker's subconscious identification of objects by their color. Colored objects and materials are prevalent in finished product areas.

Of course, where female workers are employed, the fluorescent mercury lamp should always be used.

Mercury lamps have proven to be the solution to certain supplementary lighting applications. Some years ago a "tunnel-of-light" was required for the inspection of large household appliances. Completely indirect lighting was required and a combination of 400-watt mercury and 500-watt incandescent lamps was used. Now the 400-watt J-H1 fluorescent mercury lamps do the job without the need of incandescent lamps for the proper color correction.

Mercury Lighting for the Future

The basic features of mercury lighting as illustrated in this paper are low initial cost, low overall cost, minimum maintenance, and adaptability to higher distribution voltages. Therefore, we can expect extended use of mercury lighting in industry, particularly for the higher levels of illumination.

One objection to mercury lighting for medium mounting heights is the possibility of direct glare. The comfort could, however, be improved by new luminaire designs which provide an upward component and better shielding. An upward component would be most useful where the luminaire and ceiling are within the normal field of view.

If past experience is any indication of things to come, even greater economies can be expected for mercury lighting. The results will be lower cost of lighting per footcandle, a factor that always leads to trends to higher illumination levels and better quality.

We may also expect the mercury lamp to make inroads in the commercial lighting field. Recently a large university library reading room (Fig. 12) was relighted with 400-watt J-H1 fluorescent mercury lamps in special commercial luminaires. This installation has been well accepted from the standpoint of color and improved illumination level. The mercury lamp may become the economic answer to better lighting in schools, offices and stores. There are still many new developments to come in mercury lamps, luminaires and ballasts.

DISCUSSION

GEORGE J. TAYLOR*: I like this paper because it gives a practical presentation of facts. I am happy to see wiring costs included. This projects a true picture of economics to the buyer, the specifier and the installer of mercury lighting systems.

I'm impressed with Table I where a wide variety of mercury lamps are shown for industrial lighting applications. There are other mercury lamps available today in lower wattage sizes than listed for various applications other than general lighting. In addition to this, mercury lamps in one form or another are available for use in "black light" application and sunlamps. I recall the first 400-watt "high intensity" mercury lamp made at the General Electric Vapor Lamp Company in Hoboken and the first application of this lamp in a high bay area at Tietjen and Lang also in Hoboken. It looked then as though mercury lighting was going places. Today (just 20 years later) the authors do prove that mercury lamps have grown in family and size and popularity.

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In some respects I lose my enthusiasm for mercury lamps (but not really) when reviewing the lumen output rating given in Table I and comparing them with ratings by other lamp companies. There are differences in rating of several lamp types from a low of about 5 per cent to a high of around 10 per cent. Moreover, there are some lamps that are the same for all intent but bulb sizes vary. This is unfortunate particularly for the designers and specifiers of lighting systems. It makes things a little rough for them in determining what or whose lamp to use and how all this fits into the economics presented in the paper.

On page 580 the authors state: "With clear mercury lamps it has been common practice to use a combination of incandescent and mercury lamps to produce an acceptable color quality. Today the fluorescent mercury lamps are being used in place of these combination systems to obtain full advantages of the long life and higher efficiency of the mercury source." Too bad then that the cost comparisons didn't use these lamp types. In connection with this statement, Fig. 5 shows Operating Cost:

(a) Combination E-H1 — $8613.
(b) Fluorescent J-H1 — $8044.

Now the authors agree that at least 5 to 10 per cent (I'd want more) incandescent should be used for standby lighting in the event of a power interruption even with color corrected J-H1 lamps. If this is true, then Operating Cost probably would be about the same for 70/30 combination E-H1 and say 90/10 combination for J-H1.

With this in mind, refer to page 579 where it states:— "The 3000-watt mercury and the 90-watt fluorescent systems have the lowest coefficients primarily because they have wide photometric distributions." Obviously, this relates to the specific condition which is under study for a Room Index of E. However, in Table II Reflector Efficiencies are given which put the 3kw and 90-watt fluorescent in a pretty good position with the result that coefficients of utilization increase notably from a Room Index of H to C. So for A Index rooms these lamps in modern ventilated reflectors are likely to have better coefficient values than some of the mercury lamps.

Projecting this thinking to page 581 where "rule of thumb" application of lamps is given as 18 feet for the mounting height of E-H1 and J-H1 lamps the Room Index would be A for a 30,000-square-foot area. Carrying this thought to Fig. 11 where J-H1 lamps are used it looks as though, for the type of work being done, the high quality of fluorescent lamps could apply "profitably" — (a) profitably from the standpoint of comfort, and (b) profitably in terms of economics.

The authors mention the fact that lower brightness of the fluorescent lamps would result in best overall quality of lighting. It would be really interesting to know what the "Glare Factor" system of rating comfort would show for a combination J-H1 system and a fluorescent system with the new reflector design where crosswise shielding is of the order of 30 degrees and an upward light component of about 25 per cent.

While it isn't possible to proportion costs accurately from data presented in the paper it appears that for A Index rooms with structural conditions as in Fig. 11, the overall first cost of the 90-watt fluorescent would be somewhat lower than the J-H1 system. It also looks as though the operating costs would be lower.

Another promising "high wattage" fluorescent lamp is now available for specific high bay industrial lighting application. It was originally announced as a 110-watt lamp and shortly changed to a 100-watt rating without sacrifice in lumen output. If the same pattern of lumen efficiency follows with this lamp as with other fluorescent lamps its output may soon be in excess of 7000 lumens. Here then is another tool for the higher mounting heights in industrial areas with good application outlook. In a 3-lamp luminaire design the economics should particularly be of interest.

In looking at the lighting installation illustrated in Figs. 9 and 10 it appears that there is plenty of room for better luminaire design for mercury lamps in high bay areas. The lack of uplight to reduce contrast from luminaire to ceiling is quite apparent by the dark gloomy overhead appearance of these rooms.

There are few people who fully appreciate the thousands of calculations that must be made in presenting a paper of this nature. Because I do, my hat is off to the authors for the many hours that went into making available a wonderful analysis of mercury lamps for industry.

R. R. WYLIE*: Careful, detailed analysis of the factors surrounding the solution of any problem has been a characteristic which we have come to expect from these authors. We believe the presentation given here justifies the placement of our continued trust in the results of their examination.

Unfortunately, time was not available from our standpoint to make a thorough analysis of the data presented. However, three very important facts arose during our study of the paper. We believe these factors deserve comment from the authors.

(1) What would have been the effect of the use of the new 100-watt, 70 lumen per watt high current fluorescent lamp upon the results of this analysis? A rough check using coefficients of utilization comparable to the RLM coefficients used in this presentation show it to compare favorably with comparable color quality lamps. This is a rough criterion, a fixture should be designed for this usage. Referring to Figs. 4 and 5 we roughly deduce that a multiplier of 0.75 would correct the 90-watt T-17 figures to the use of the new lamp. The cost of lighting would then be about $7600 — not a very bad comparison against the straight mercury vapor shown in Fig. 4 and a very good comparison when stacked against the data of Fig. 5.

(2) We feel that industrial seeing is more important than the effort which is devoted to it by the research teams of the lighting industry and the I.E.S. task committees. Consider for the moment the investment involved in the average office compared to industry. The value per square foot of floor space (unoccupied) is equal or less. The industrial worker generally commands a higher wage per hour, particularly in those industries where mercury vapor is applicable. The cost of the manufacturing equipment which he uses may run 1000 time or more per square foot than the cost of the equipment used by secretarial or other office help. And his product is the thing which pays the way for the office help. It he can't see because of glare, shadows or other psychological hazards, even though he has 50 foot-candles, the loss can be appalling. Therefore we feel the provision of the best in quality for industrial vision is at least as important as providing those optimum seeing conditions we strive for in schools, offices and other white collar locations. And mercury vapor, incandescent and fluorescent sources should be incorporated into equipment which recognize this fact.

Consider the examples given in the bar graphs of Figs. 4 and 5 on the basis of the area studies and on the basis of

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lighting quality. The area per square foot lighted by one fixture varies from 188 feet per square foot for the 400-watt E-H1 to 857 feet per square foot for the 3-kw A-H9 in Fig. 4. The 400-watt J-H1 uses 178 square feet and the combination 400-watt E-H1 and incandescent arrangement 188 square feet. Unfortunately time permits no study of the 1000-watt color corrected lamp. The fluorescent example shown requires 72 square feet per fixture. A 100-watt T-12 high current lamp would require about 100 square feet.

On a 40-foot mounting height certainly there will be objectionable shadows in some areas with the highly concentrated high wattage packages of light. This is particularly true in those heavy industrial areas where these lamps find their greatest use.

For comparison purposes we feel the use of mercury vapor color corrected lamps is the only fair comparison to be made to fluorescent. Then it is only fair if fixtures designed to accommodate fluorescent lamps to be used at high mounting heights are used.

(3) Could the authors in some future paper put together a coherent picture of the place high voltage distribution systems may play in industrial building today? Too often in "jumping on the bandwagon" engineers even have found that percentages of low voltage loads required because of equipment available, have completely dissipated the theoretical gains presented by manufacturers in their enthusiasm for a new product.

B. S. Benson, Jr.*: It is always interesting to read over a paper on economics and the authors' contribution is certainly no exception.

The authors will no doubt agree that their results are not all-inclusive but are based on a certain set of conditions and results may vary considerably under other situations.

Fig. 4 lists the results for 4000 burning hours per year (2 shifts per day). For one-shift operation it can be expected that those systems having a large portion of their yearly cost in power (incandescent for example) will tend to more nearly approach the yearly cost of the mercury systems which have a lesser power consumption. For three-shift operation the reverse will, naturally, be true.

With incandescent lighting systems a considerable saving can often be realized by using group relamping and, also, by operating the lamps at 2000-hour life instead of the 1000 hours normally rated. Double lamp life is usually achieved by operating the lamps at 5 per cent undervoltage either by changing transformer taps or by using lamps of 5 per cent higher voltage rating than measured line volts. The reduction in operating voltage requires more lighting equipment for equal footcandles but this is usually more than offset by the decrease in operating costs.

I am sure the authors will agree that the monetary cost of owning and operating a lighting system is not the sum and substance of good lighting. The selection of the type of luminaire best suited for a particular installation should be based, not only on economics, but on such other considerations as uniformity of illuminaion, reduction of shadows, position of the working plane, brightness ratios, etc. A spread type reflector, for example, may deliver less light to a horizontal work plane than one more concentrating but will more than make up for it in increased vertical illumination, reduced shadows, increased uniformity and increased wall brightness. These qualities do not show up in an economic study but are of great importance in many applications.

*Benjamin Electric Mfg. Co., Des Plaines, Ill.

While the fluorescent mercury lamp has a decided improvement in color over the regular mercury lamp there is still much to be desired as far as "correction" is concerned. To many people the mixture of light on an "equal-lumen" basis is definitely less objectionable than the 70 per cent to 30 per cent ratio mentioned in the paper. There have been a number of occasions where the user has felt it desirable to combine fluorescent mercury and incandescent for improved color quality.

E. A. Linsday*: This economic analysis of mercury lighting is well handled and presented in a straightforward, easy-to-follow style. In any economic study comparing different light sources it is necessary to make many assumptions. These assumptions in the present paper are well considered and appear entirly reasonable.

Several paragraphs in the paper, however, need further explanation or clarification. For example, the statement is made that reflector lamps are not considered in the analysis because previous studies have shown no economic advantage for these lamps over standard lamps and reflectors. Our experience is at variance with this statement. Reflector lamps usually show cost advantages, particularly in areas with serious dirt problems.

It is also stated that fluorescent and filament lighting have the same annual cost and that both are considerably higher in cost than mercury lighting. Again, our data are different from this. We generally find mercury equal to or slightly lower in cost than fluorescent and both markedly lower in cost than filament.

A statement is made to the effect that specular reflectors separate the mercury light from the arc from the light generated by the phosphor if they are not properly designed. This effect is questionable because of the completely diffusing characteristics of the phosphor coating. We have never been able to note such a phenomenon and wonder if it is actually a problem in reflector design.

Because of the rapid changes in the mercury lamp line today there have been significant additions to and changes in the mercury lighting picture since the paper was prepared. Some of these changes may change the emphasis on certain of the types discussed in the paper.

The authors are to be congratulated for their recognition of the tremendous importance of the environmental aspects of lighting, taking into account the higher quality installations which are being used today. The importance of upward light, shielding, and light finishes cannot be over emphasized.

The authors suggest the possibility of wider application of the mercury lamp in such fields as schools, offices, and stores. In view of the serious color limitations with these lamps equivalent to 70 per cent mercury, 30 per cent filament, according to the authors of this paper it would certainly seem to be poor practice to utilize these sources in a social environment. I would be interested in further information on the J1 installation in the library which was illustrated in the paper.

W. H. Kahler**: The authors appreciate the discussions presented on this paper because they indicate the interest in the subject of mercury lighting and extend the overall coverage of the paper. No cost analysis can be made to cover all conditions because the variables are so wide-spread. It was intended that this cost analysis would cover a typical situation as outlined in the paper but for specific conditions

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**Co-author.

that differ from the conditions of this analysis a specific economic study should be made.

It was not intended that economy is to replace consideration of quality where superior quality is required. However, economy and quality must be weighed with an objective viewpoint to obtain practical results. The reflectors used in the systems in the economic study are not highly concentrating and, therefore, shadows would not be as harsh as was indicated by one discussor.

The 800 milliampere 96 inch rapid start lamp had been just announced at the time this paper was being completed and, therefore, there was not enough equipment data available at the time to include this lamp in the economic study. This high current lamp, however, is certainly suitable for the applications selected for the economic study and the discussors were justified in commenting on the possible economy of this new lamp. The authors have calculated the economics of the 100 watt 96 inch rapid start lamp and the overall annual cost is $8688.00. This value should be compared with the other over-all cost of lighting values in Fig. 4 of the paper. The annual cost of the 100-watt 96 inch lamp is somewhat higher than the most expensive mercury system, but is considerably less than the system using 90-watt fluorescent lamps. This new light source is particularly suitable for medium and high mounting heights and the economics are more favorable than any other fluorescent lamp previously available.

The authors would like to repeat that the problem of color separation is a problem in the design of specular reflectors. The reason for this problem is that all fluorescent mercury lamps are not completely diffused with the fluorescent phosphor coating.

The cost relationship of mercury, fluorescent and incandescent lighting shown in the cost analysis in this paper are, of course, the result of the conditions of the particular application considered in the paper. This analysis is considered a typical high bay application with 40′ mounting height because mercury lighting is normally used in high bay applications. The relationship of mercury, fluorescent and incandescent lighting would change, to some extent, at lower mounting heights or where room proportions give a higher room index. For example with a room index of "C" annual over-all cost would be reduced for the E-H1 system from $7388.00 to $6950.00, for J-H1 system from $8044.00 to $7600.00, and for 90-watt fluorescent system from $10,062.00 to $8800.00. The authors could have made this paper more complete by including cost analyses on a typical low bay application as well as the high bay application. However, time and space did not permit the inclusion of cost studies of all of the variables that affect the annual cost of industrial lighting systems. This is, however, another illustration of the reason that a specific cost analysis should be made for any application problem where it is desirable to study the economics of various lighting systems.

Determinants of Fluorescent Lamp Life

Discussion of paper by Richard N. Thayer

(Published November 1954 ILLUMINATING ENGINEERING)

DOMINA EBERLE SPENCER*: This is an interesting and valuable paper. There are, however, two factors on which no quantitative information is given:

(1) The first is the effect of the *frequency* of the supply voltage on lamp life. In view of the excellent work of John Campbell,[1] we should generally recognize that in the future not all lamps will be operated at 60 cycles per second. Operation at 400, 3000, 6000 or even 10,000 cycles per second has been shown to be practical and advantageous. At higher than standard frequencies, the work of Campbell and of Coradeschi[2] has indicated that lamp life is significantly increased. More data on this question are needed and I would like to inquire whether such tests are now in progress.

(2) The second is the *starting transient*. In this paper the wave shape in steady state operation and the magnitude of the starting current are considered. But the character and duration of the starting transient are not discussed. These factors appear to be important in determining lamp life and can easily be investigated by recording oscillograms of the starting current and voltage. Is a specification of the magnitude of the starting current sufficient? Or should wave shape and duration of the starting transient also be included?

1. Campbell, J. H., Schultz, H. E., and Kershaw, D. D.: "Characteristics of High-Frequency Fluorescent Lighting." ILLUMINATING ENGINEERING, Vol. XLVIII, No. 2 (February 1953).
2. Unpublished material.

A. E. FEINBERG*: I have observed in preheat start with the glow starter that for each start, the starter may flicker several times instead of starting with the first try. What effect if any has this on lamp life as compared with test figures and what effect if any has this in comparisons with trigger start?

C. W. JEROME**: I believe that we are in essential agreement with most of the points made by Mr. Thayer. However, there are one or two points to which I would like to take slight exception, some which I think should be clarified, and some with which I am in such hearty agreement that I would like to emphasize by repeating.

Mr. Thayer's disagreement with Dr. Lowry's data as

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**Sylvania Electric Products Inc., Salem, Mass.

illustrated in Fig. 5 is real. Our data on the effect of fill pressure on lamp life does not show the sharp increase at high pressures shown by Mr. Thayer. I can only suggest that this may be due to different manufacturing techniques used for the lamps on which the data are based, or differences in the ballasts used for the testing. Another possible explanation for the disagreement is that Dr. Lowry's data referred to was for lamps prior to the advent of the zirconia cathode. I would like to point out one serious disagreement in these data.

Regarding Fig. 6, Lamp life vs operating current, I think it should be emphasized that the curves can be moved either to the right or left by the proper design of the cathode. That is, a fluorescent lamp can be operated at 1.0 ampere or any other reasonable current without seriously impairing its life expectancy provided the cathode is properly designed to handle this current.

I would like to add a comment to Mr. Thayer's remarks on ambient temperature. Some rather limited tests I have made indicate that for any given set of operating conditions there is a constant differential between ambient and bulb wall temperatures until very high ambient temperatures are reached. That is, over ordinary temperature ranges, if the ambient temperature is raised or lowered it is accompanied by an equal variation in the bulb wall temperature.

I would like to agree most heartily with Mr. Thayer's comments on "instant-starting tendencies on lead circuits" and their deleterious effect on lamp life. This is a very serious problem at the present time and one which has been worsened by the constant improvement in the fluorescent lamp, that is, as its starting has been made easier and more reliable. This has been the cause for serious thought being given to the use of straight-line reactors for all life testing.

On the whole, I think the author is to be commended for a very comprehensive resume of the conditions affecting fluorescent lamp life and the effects to be expected in variations thereto.

J. W. STRANGE*: I should like to refer to the reported reduction of lamp life which occurs on trigger start circuits because from British experience the reverse is the case. There was introduced in Great Britain eight years ago a type of circuit under the title of quick start or instant start similar essentially to your trigger or rapid start. There is some difference here due to confusion of terminology but these circuits were essentially cathode heating transformer circuits but using a high enough cathode voltage during the starting conditions to permit use of standard lamps. An additional humidity resistant layer was of course necessary. One of the features of this circuit was the reduction of life which resulted if the cathode heating was inadequate and the open circuit voltage was raised to facilitate starting. Another feature which also had a bad effect was the presence of a grounded metal surface too close to the lamp. This also permitted starting before cathode heating was adequate and resulted in a "creep" start which was very bad for the cathodes. The conclusion reached as a result of this experience was, that if cathode heating conditions are such that no attempt to strike is made before full thermionic emission is available, no deterioration of lamp life results whatever the number of strikes. This may be illustrated by the results from a "flasher" circuit including cathode heating in that to date 40 million starts have been recorded without any reduction of lamp life.

*Thorn Electrical Industries, High Gate, England.

G. C. HARVEY*: Most of the large number of subjects treated in this very weighty paper are of extreme interest to the ballast designer. But probably the most salient one is the admission that there is no way to evaluate new circuits and lamps without long and arduous life testing. In this industry which wants to move and change rapidly, this problem becomes a very serious throttle to the ballast designer. I know the author has spent much time and energy trying to find a solution, and I sincerely hope he and others will continue to accept, and wrestle with, this very important challenge.

The problem of rectification at lamp failure in instant-start circuits is quite complex, and is being studied by certain industry standards groups. While this paper gives only a paragraph to it, it deserves a separate treatment, and no doubt more will be written soon.

On the subject of tendency to instant start 48T12 switch start lamps in lead circuits, a summary would disclose that the following are contributors:

Lamps start more easily, grounded metal acts as starting aid, ballasts have high peak voltage, and glow starters produce transients. Will the author please list these in order of importance and assign an approximate "contributing" value to each? Also will he please explain these glow starter transients and why they are peculiar to lead circuits?

Fig. 11 appears to be a substantial increase in data over that presented three years ago by Hinman, Keiffer and Strecker. I suggest that clearer captions might be used, for certainly these data apply only to instant start and not to rapid start. Perhaps the reader is further confused when he notes that series rapid start is favored over lead lag because of improved lamp life. More data here would be helpful. I have felt that the ratio would be 2 to 1 in favor of series rapid start. Does the author have any data he can present?

The paper reports shorter lamp life for series instant-start circuits when compared to lead-lag. This prompts the question — don't lamp manufacturers agree that normal lamp life ratings still apply to series instant start ballasts which meet the starting specification?

R. N. THAYER**: On Dr. Spencer's question on relative lamp life at supply frequencies above 60-cycle, our only life testing to date has been at 360-400 cycles, since that is the high frequency range of greatest immediate practical promise. Our only life test yet completed at this frequency was inconclusive with respect to the frequency variable alone because it also included variations in ballasting methods. A second life test, now in progress, will permit the frequency comparison. We do not anticipate any loss in lamp life at higher frequencies, and there well may be some gain. We agree that theory would definitely indicate an effect on lamp life for variations in magnitude, duration, and wave shape of the starting transient. However, our experiments have indicated no major effect. The dependence of lamp life on starting frequency (Fig. 8) arises, we think, chiefly from the fact that cathode preheating is sometimes short of ideal with commonly used starter designs. Then, emission material is sputtered from the cathode during starting because it is not fully up to emitting temperature. If ideal cathode preheat is assured at every start, we would estimate much less dependence of lamp life on starting

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frequency. A practical obstacle to directly testing the effect of variables in starting transients on life is the fact that we find no two successive starting transients are alike, despite our attempts to control available variables.

Mr. Feinberg's question on the effect of momentary flashes that fail to start a switch-start lamp is related to the one on starting transients already discussed. Since the cathode is usually well heated when these flashes occur (of insufficient energy or duration to start the lamp) we think they are relatively harmless. One test we made was to run thousands of such flashes through a lamp, by discharge of a capacitor to give the same intensity of light as was found typical of the intensity of these flashes in a commercial circuit. No end-discoloration or cathode deactivation was observed, and so we concluded that there is no large effect on lamp life. Mr. Feinberg further asks for a comparison of the harm this does with the harm to lamp life from a trigger-start circuit. On the latter, as the text indicates, we know a 30 per cent loss in life occurs, probably because of frequent instant-starting. This loss occurs in comparison with control lamps on switch-starting, with whatever flashing may occur through them in starting during the life test. So, any loss in life from these momentary flashes is already included in the control lot.

On the discrepancy shown by Fig. 5 between our data and Lowry's, we can only emphasize that ours represents the averaging of eight tests run at scattered intervals over several years, and all of them agree much more closely among themselves than with the Lowry data. The series of tests included cathodes both with and without zirconia addition. The steep slope which we find is further supported by data not included in the paper, covering the pressure range of 3.5 to 8 mm for slimline lamps.

Mr. Jerome properly points out that Fig. 6 is only designed to show the effect on life of overloading or underloading a cathode designed for a certain current. By suitable redesign, a full-life cathode may be designed for any current shown on the graph.

Our results confirm Mr. Jerome's that the differential between bulb-wall and ambient temperatures is constant for a fluorescent lamp in a given setup, throughout the range of ambient temperatures normally encountered in service.

Mr. Strange's comments are most interesting, and confirm ours. Any disagreements apparently result from problems of terminology. The British have found good lamp life for what U. S. practice would call a "rapid-start" circuit; *i.e.*, one in which adequate cathode preheating from supplementary cathode heating circuits is assured before the arc strikes, by controlling environmental variables which affect the ease with which the arc strikes. These include high-humidity protection on the lamp, and control of fixture distance and potential. Open-circuit voltage can then be set relatively low. Also, he reports British experience with shorter lamp life for the conditions which apply to the "trigger-start" circuit; *i.e.*, a ballast designed with a relatively high open-circuit voltage to start ordinary lamps without control of these variables. Under these circumstances, lamps often instant-start under favorable starting conditions in their surroundings, with the consequent loss of life shown by Fig. 9 of the text.

Mr. Harvey first requests relative evaluation of the various factors that contribute to instant-starting of switch-start lamps in lead circuits. Only qualitative comments can be given, since the factors are overlapping in most test and service examples. The contribution of easier lamp starting by manufacturing improvements over the years is least tangible, since comparable lamps are not available for test. We have always known that grounded fixtures, the common environment for most lamps in actual service, help the arc to strike; this is an important variable, but not one that has changed in any way over the period in question. Its contribution to instant-starting can be eliminated only by special potentials on the fixture that can be readily obtained in laboratory test, but not in normal service. The development and marketing, after World War II, of ballasts with peaked open-circuit voltages, is an important contributor to instant-starting on lead circuits, and up to a year ago we regarded it as the chief cause. It is only work work done since then, much of it subsequent to the submission of this paper early in 1954, that the equally or more important role of the glow-switch starter was discovered.

Its role in producing instant-start transients is complicated for detailed analysis here. Briefly, the unsymmetrical structure of most glow-switch starters produces a partially rectified current flow while the starter is glowing. On the lead circuit, this results in charging the series capacitor to a potential during the forward half-cycle that is not fully reversed in the inverse half-cycle. So, a voltage is built up across the capacitor that is higher than the open-circuit voltage of the ballast, and this high voltage also appears across the lamp. An additional but less important factor contributing to instant-starting is the tendency to produce transient voltage peaks of the argon gas commonly used in 40-watt fluorescent lamp starters. A redesigned starter has eliminated most instant-starting on lead circuits by eliminating these causes of high voltage.

As for the comments on Fig. 11, the text of the paper indicates that it refers only to series circuits for instant-start lamps. As both the text and Mr. Harvey indicate, series circuits on rapid-start lamps give longer life than do lag-lead, but we don't yet have enough data to furnish a reliable ratio. Returning to Fig. 11, lamps will deliver rated life if the series circuit delivers the minimum specification value of 100 ma starting current. The general subject of lamp performance with respect to specification limits is fully covered in the text, in the first paragraph under the heading "Operating and Service Variables."

February 1 is Deadline For 1955 Conference Paper Outlines

A deadline of February 1 has been set by the Papers Committee for outlines of proposed papers for the 1955 National Technical Conference. Outlines of proposed papers, in triplicate, should be mailed to:

Dr. R. M. Zabel
Chairman, I.E.S. Papers Committee
Westinghouse Electric Corp.
Bloomfield, New Jersey

A Lumen Integrator For Semi-Automatic Distribution Photometers

By W. GLENN PRACEJUS
G. H. ZAAR

A NEW instrument, a lumen integrator, has been developed for use with semi-automatic polar distribution, photometers to compute and record lumens. Simultaneous with the completion of the photometry, a printed tape is available indicating the lumens in each zone. This instrument is expected to open new fields to the fixture designer and present another major advancement in the automation of polar distribution photometry.

The basic idea of a lumen integrator is not new—one has been in use for more than three years in a laboratory for lighting design data.[1] However, combining a lumen integrator as a major component of a distribution photometer is new. The need for such a device has been obvious for some time and was formally proposed three years ago.[2]

The introduction of the semi-automatic distribution photometer reduced the time and labor required to obtain candlepower distributions. This development also served to simplify the calculation of lumens.[3] Great savings in time and labor were credited to this innovation along with simplified calculations. Subsequent developments in this field have been concerned with the physical movement of the light cell, fixture suspension and recording of candlepower data. They have not eliminated errors introduced by certain assumptions in the conventional method of calculating lumens. There are two inherent errors in the conventional zonal-constants method for calculating lumens.[4] The first cause of error is that a single selected candlepower value at the midpoint of a zone is not necessarily the average for the zone. The second is the changing ratio of lumens to candlepower at different angles within a zone. Only through the use of smaller and smaller zone intervals can these errors be eliminated. This has been accomplished in the lumen integrator described in this paper.

The lumen integrator consists of a control unit, two decimal counting units, mechanical integrators and a timing unit. The arrangement of these components is illustrated in Fig. 1. The integrators and timing unit are combined in one cabinet and mounted on top of the rack which houses the other units. The decimal printer or read-out unit is in a separate cabinet and may be remotely located. To operate the lumen integrator with a distribution photometer only two minor modifications were required. These are: the addition of a slide wire resistor mounted in the candlepower recorder, and an on-off contact controlled by the movement of the rotating member of the photometer. The slide wire is mounted on the slide wire shaft of the recorder and develops a signal proportional to the candle-

Figure 1. A lumen integrator for use with semi-automatic distribution photometers. A control panel and two decimal counting units are rack mounted. The mechanical integrators and timing gears are mounted in a separate clear plastic cabinet. A decimal printer or read-out unit may be remotely located.

AUTHORS: General Electric Co., Lamp Dept., Engineering Div., Nela Park, Cleveland, Ohio.

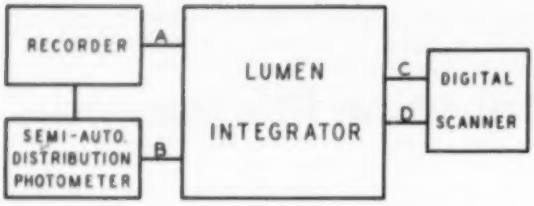

Figure 2. A block diagram of the lumen integrator with its connections to a semi-automatic distribution photometer.

power of the source. Two contact switches start and stop the integrator at the beginning and end of travel. This particular model of the lumen integrator was developed to operate with photometers that are synchronously driven at the rate of 90 degrees per minute or 90 degrees in five minutes. Other speeds can be used if appropriate gears are used in the timing unit.

The block diagram, Fig. 2, indicates the connections required from the photometer to the lumen integrator. The candlepower signal developed by the light-sensitive cell is transmitted to the recorder. A proportional signal is transmitted by cable A to the lumen integrator; the starting and stopping impulse is transmitted by cable B. The lumen integrator weights the plane being measured and continuously integrates the candlepower multiplied by the sine function for the angle. In the photometry of non-symmetrical sources the usual testing procedure requires candlepower distributions in the lengthwise, crosswise and 45-degree planes. Normally one of each of these planes is measured. The indicated lumens in lengthwise and crosswise planes are multiplied by a factor of 0.25 and in the 45-degree plane by 0.5. These factors weight the planes according to the proportional share of the sphere each represents and the sum is equal to unity.[3] In other words, by automatically incorporating the weighting factor, the total lumens are obtained directly from the summation of the zonal lumens for the three plans. In the case of a rotating source, a single plane is representative of total lumens and the weighting factor is unity. This integration is transmitted as a series of pulses to a gating circuit. The gating circuit transmits these pulses to one of two digital scanners. When the photometer moves from the first to the second zone, a signal triggers the gating circuit and the series of pulses is transferred to the second counting unit. While counting unit No. 2 records the pulses in the second zone, the unit No. 1 holds its total until it is printed on tape by the read-out unit. The latter is actuated by the same signal which transfers the pulses from one counting unit to the other. This alternating sequence continues until the last zone has been measured when the lumen integrator automatically stops. It is possible to record lumens in half, one and five-degree zones.

The lumen integrator was designed to operate with two specific photometers. One photometer scans 90 degrees in one minute and must be reset to traverse the second 90-degree zone. A second photometer is designed to scan 90 degrees in either one minute or five and can traverse a 180-degree zone without interruption. The speed of the mechanical read unit limits the size of zone used for the high speed condition (90 degrees per minute). That is, the time per zone must be longer than the time needed by the read-out unit to record the zonal lumens which is about 0.75 second. Directional sources have beam spreads ranging from 10 to 120 degrees and usually are symmetrical. In photometry of these sources the slower speed and zones of half or one degree are used and a total cell traverse of five to sixty degrees.

Only five adjustments must be made to place the integrator into operation:

1. Turn on master power switch.
2. Set zero or ninety degrees for the start of run (accuracy of seeing is approximately ±5 seconds of angle).
3. Select appropriate zone (½°, 1°, 5°).
4. Select proper weighting factor for plane (× 0.25, × 0.5, × 1).
5. Select speed (90° per minute, 90° per 5 minutes).

After recording the lumens for the first plane only steps 2 and 4 need be repeated.

This lumen integrator presents a new practical method for increased accuracy in distribution photometry. It is fully automatic after a few simple adjustments have been made. Furthermore, it does not require an experienced operator. The results of calculations are printed on a tape eliminating the possibility of error from reading charts, and presenting a permanent record for reference. The only necessary computations involve addition of the zonal lumens. In those special cases where only total lumens are required, it is not even necessary to draw a candlepower curve.

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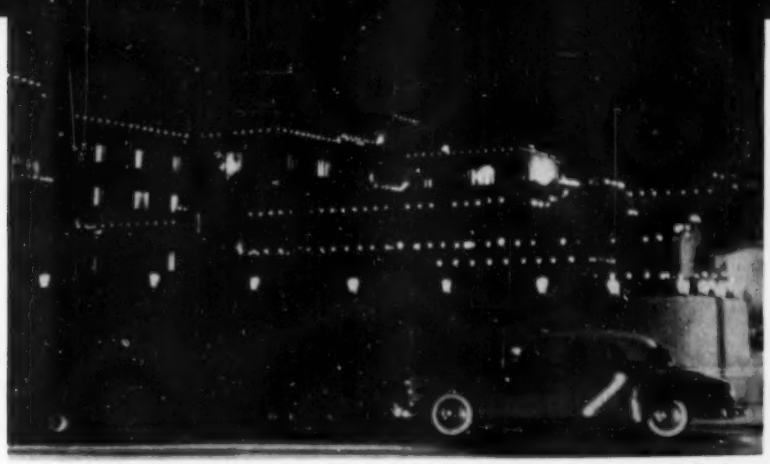
3. New Semi-Automatic Distribution Photometer and Simplified Calculation of Light Flux, G. R. Baumgartner, ILLUMINATING ENGINEERING, Vol. XLV, p. 253 (1950).

4. A More Precise Method of Computing Zonal Lumens, D. A. Toenjes, ILLUMINATING ENGINEERING, Vol. XLVI, p. 335 (1951).



Farolitos (or candle-in-a-sack) decorating La Fonda Hotel, Santa Fe, New Mexico during the Christmas season.

Photo by Sinex

A Christmas Custom in an Ancient City

By CARL R. ALBACH

MORE than 200 years before Edison's birth, the inhabitants of what is now New Mexico had already established a type of outdoor lighting for the Christmas season which is still in use today. As early as 1626, in a visit to Santa Fe, New Mexico, Benavides noted that the people of the Ancient City, following a custom of long standing, lit their little bonfires to herald the beginning of the religious holidays. This lighting display custom pre-dates even the Christmas tree, perhaps by many years.

In 1846, Lieutenant Emory wrote that during the fete of Tome he had been puzzled at seeing piles of dry wood placed at regular intervals on the wall surrounding the *capilla* (or chapel), and on the turrets of the *capilla* (which, he pointed out, were made of mud). At a given signal, all of these fires were lighted.

The term given to these small bonfires, which are still a part of the Christmas decoration of some of the Spanish-Americans in certain areas of New Mexico, is "Luminaria" (loo-me-nah-re-ah, meaning illumination or festival lights). Even in this modern time on the day before Christmas the writer has seen these small bonfires or *luminarias* being set out at the curb along certain of the streets in Santa Fe. Legend has it that the Christ Child wanders through the snow each Christmas Eve seeking shelter and He will bless the homes of those who burn a *luminaria* to light His way.

The more modern version of this outdoor Christmas lighting is the "Farolito" (fah-ro-lee-to, meaning small lantern). It consists of a paper bag partly filled with sand, into which is inserted a vigil candle. The top of the bag is folded down about two inches to give support to the open top. The brown sack, being stronger, is used in preference to the white and the #5 is about the most popular size, since larger bags admit more air and consequently the candles burn faster and more unevenly. A one-third fill of sand is considered enough to hold the candle steady in the wind, to keep the candle in place and to act as a snuffer when the candle burns to that point. These *farolitos* are usually placed about two feet apart along the parapets of the flat roofed *adobe* houses, as well as on the garden and patio walls, where they have been known to burn as long as ten hours.

Many Anglo-Americans in the "Land of Enchantment" have adopted the custom of burning *farolitos* — or *luminarias*, as they are loosely called — for their outdoor Christmas lighting. These paper lanterns may also be seen outlining house and building roofs during *Fiesta* and on other special occasions. Some establishments have modernized the "sack-with-candle" by using a small light bulb in a paper bag. Others have taken plastic screen, painted it brown and inserted 10-watt bulbs in place of candles. In spite of this new trend there is still much to be said for a flickering candle flame inside a brown paper sack.

This ancient form of outdoor Christmas lighting really has to be seen first hand to be appreciated. Whether it is used with candle or light bulb, whether it is called *farolito* or *luminaria*, it provides a simple and yet effective form of lighting for the Christmas Season.

AUTHOR: Consulting Engineer, Santa Fe, New Mexico.

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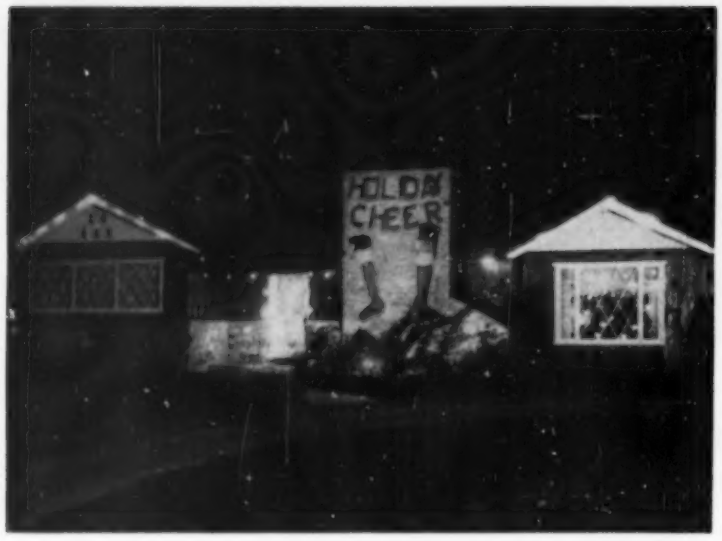
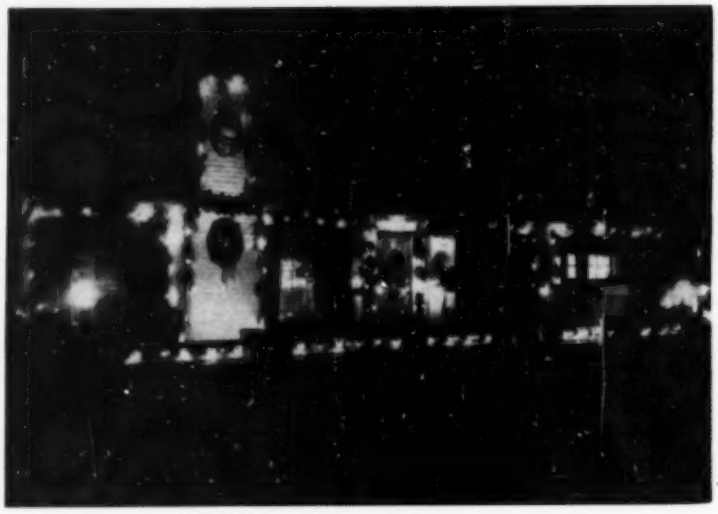


Floodlighted fieldstone chimney is used as a signboard to convey Christmas Cheer. Strings of lights are hung along the eaves and around the door.



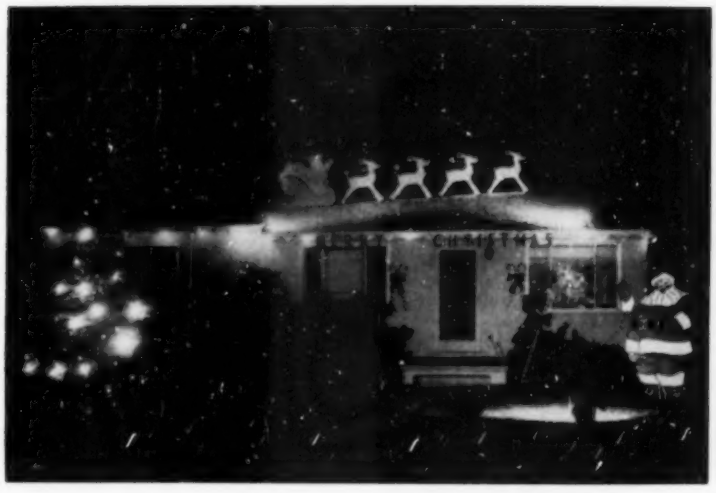
A long veranda, bedecked with wreaths and pine boughs shines hospitably against the dark sky and lawn. Horizontal lines of the long building front are dramatized by the floodlighting of the chimney.

Stately columns of classical architecture express dignity lighted from the lawn and corners of the roof. Clumps of boxwood are strewn with Christmas lights and cheerful Santa waves a warm greeting.

Structural elements of these houses are highlighted to make Christmas card scenes expressing the holiday sentiments of good cheer, best wishes to all and . . .

Two-decker treatment of Christmas trees is emphasized by the frame of lights outlining the two windows as one unit.

Season's Greetings



"Approach lighting" on the roof enables Santa and his reindeer to land and take off safely — without tangling in the TV aerial. Floodlighting from the lawn, lighted tree and seasonal decorations combine to say "Merry Christmas."

Photos submitted by Roy Kreyser, Dept. of Water and Power, Los Angeles, Calif.

Questions and Answers on light sources

The I.E.S. Committee on Light Sources, under the chairmanship of H. F. Davidson, has prepared these answers to some frequently asked questions. Readers are invited to submit similar questions of general interest on light sources to be considered for publication. Questions may be sent in care of Society Headquarters.

What is the distribution of energy from incandescent filament and fluorescent lamps?

	40-watt white fluorescent	500-watt incandescent filament
light	16.5%	12%
heat radiated	37.5%	73.8%
heat by convection and conduction	46%	14.2%

Is heat the most common cause of fluorescent lamp ballast failure?

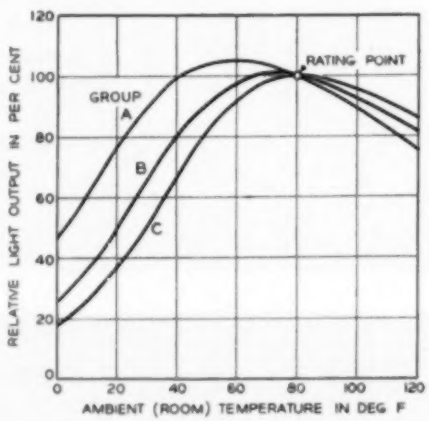
The life of fluorescent lamp ballasts is closely related to the temperature at which they operate. High temperature is unquestionably a primary cause of reduced ballast life. About 20 per cent of the input watts to the luminaire results in ballast heat. If this heat is not dissipated rapidly enough the ballast will become overheated. This will cause the components in the ballast to deteriorate and the ballast life will be shortened.

Is it practical to place fluorescent lamp ballasts at some central location where they do not affect the cooling load?

In some instances it is practical to place ballasts at some central location where they do not affect the cooling load adversely. With some extra initial costs in wiring, the slimline type or 40-watt instant start type is often installed with a central panel for ballasts located elsewhere. This will reduce the wattage dissipated at the luminaire by approximately 20 per cent. Small offices, refrigeration rooms, etc., can be advantageously wired this way. In view of the additional wiring costs, the economics of each individual application would have to be considered.

What is the effect of temperature on light output of fluorescent lamps?

The light output of a fluorescent lamp will be affected by the lamp operating temperature which is in turn affected by the degree to which a lamp is enclosed by a luminaire or is subjected to drafts. The following curves show the effect of ambient temperature on the light output of fluorescent lamps operated in still air at rated watts.



Curves A, B and C are respectively for heavily, medium, and lightly loaded lamps (arc watts per square inch of bulb wall area). Typical lamps of each group are as follows:

Group A (heavily loaded)	Group B (medium loaded)	Group C (lightly loaded)
15T8	15T12	40T17
30T8	20T12	72T8 at 120 ma
64T6 at 200 ma	40T12	96T8 at 120 ma
96T8 at 300 ma	72T8 at 200 ma	
100T17	72T12 at 425 ma	
	96T8 at 200 ma	
	96T12 at 425 ma	

Among the numerous duties specified for the General Secretary in the Constitution is the requirement that he prepare annually a report for publication in the designated official publication, ILLUMINATING ENGINEERING. This report, based on material received from the Officers, Committees, and Sections and Chapters, has been assembled with the assistance of the staff at headquarters. A brief preview of certain phases of this report was presented at the opening session of the National Technical Conference in Atlantic City, September 13.

The General Secretary Reports

By MARSHALL N. WATERMAN

Membership

Statistics — Table I of this report shows the present membership of the Society compared with figures at the conclusion of each of the past six fiscal years. These figures continue to show a growth in the major membership classifications with a small decrease in the Student Member group. The increase in the membership during the past year has been at a slower rate than during recent years. The growth of the Society's membership since 1906 is shown graphically in the curves of Fig. 1. It is interesting to note the proportionately greater increase in the Member grade group in recent years.

Table II of this report records the gains and losses for the year and the general accounting of changes in all grades of membership. The over-all net increase of 106 brings the total membership of the Society to 7902. Table III records the Society membership by Sections and Chapters divided according to grade of membership. These figures offer a challenge to many local groups where there are possibilities of higher proportions in the Fellow and Member grade.

Members Emeritus, Fellows — The Constitution of the Society specifies two grades of membership designed to recognize Members who have made contributions to the activities of the Society and to the general field of illuminating engineering. This year action was taken by Council naming as Members Emeritus four who performed for the Society services of such meritorious character as Council deemed worthy of this honorable reward. They are:

Lester H. Graves — A. B. Oday
N. A. Halbertsma — John H. Waterbury

Based on their valuable contributions to the technical activities of the Society and to the science or art of illumination 10 Members of the Society were recommended by the Board of Fellows and were approved by Council. They are:

Carl E. Egeler — John Neidhart
Myrtle Fahsbender — R. L. Oetting
Dan M. Finch — Roy A. Palmer
Kurt Franck — C. H. Rex
K. S. Gibson — Francis Wyatt

TABLE I.—Membership as of September 30.

	1949	1950	1951	1952	1953	1954
Members Emeritus	26*	33*	32*	34*	32*	34*
Fellows	44	40	42	41	70	78
Members	1,521	1,610	1,709	1,797	1,870	1,939
Associate Members	5,048	5,005	5,174	5,293	5,579	5,621
Student Members	244	369	209	229	244	230
Total	6,883	7,057	7,166	7,394	7,795	7,902
Fellows of the Society included	*5	*9	*10	*11	*12	*12

TABLE II.—Gains and Losses in Membership During Year Ending September 30, 1954.

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
October 1, 1953	32	70	1,870	5,579	244	7,795
Gains						
Elections	0	0	89	740	84	913
Reinstatements	0	0	33	139	3	175
Transfers	4	10	70	15	0	99
Total Gains	4	10	192	894	87	1,187
Losses						
Resignations	0	1	51	332	25	409
Dropped	0	0	44	418	61	523
Deceased	2	0	16	31	0	49
Transfers	0	1	12	71	15	99
Total Losses	2	2	123	852	101	1,080
Net Change	+2	+8	+69	+42	−14	+107
Total Membership as of September 30, 1954	34*	78	1,939	5,621	230	7,902

*Includes 12 Fellows.

TABLE III.—Membership of Sections and Chapters as of September 30, 1954.

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
CANADIAN REGION						
Hamilton, Ontario Chapter	0	0	5	22	0	27
Maritime Chapter	0	0	7	26	0	33
Montreal Section	0	0	35	83	0	118
Ottawa Chapter	0	0	11	25	0	36
Quebec Chapter	0	0	8	31	0	39
Toronto Section	0	3	43	168	0	214
Winnipeg Chapter	0	0	5	49	0	54
EAST CENTRAL REGION						
Capital Section	1 (1 F)	3	37	52	1	94
Eastern Pennsylvania Section	1	0	44	118	0	163
Maryland Section	0	0	21	54	1	76
Philadelphia Section	1 (1 F)	4	84	205	3	297
Pittsburgh Section	0	0	62	148	2	212
Virginia Chapter	1	0	21	21	0	43
GREAT LAKES REGION						
Central New York Section	1 (1 F)	1	31	77	1	111
Cleveland Section	5 (2 F)	22	100	224	10	361
Miami Valley Chapter	0	1	9	32	1	43
Michigan Section	1	2	67	188	8	266
Northwestern Ohio Chapter	0	0	18	42	1	61
Ohio Valley Section	1	0	27	71	0	99
Rochester Section	0	1	13	69	0	83
Western Michigan Chapter	0	0	15	40	0	55
Western New York Section	0	1	10	55	2	68
INTER-MOUNTAIN REGION						
Arizona Chapter	0	0	14	52	1	67
New Mexico Chapter	0	0	6	25	0	31
Rocky Mountain Section	0	0	13	56	0	69
Southern Colorado Chapter	0	1	6	26	0	33
Utah Chapter	0	0	19	46	0	65
MIDWESTERN REGION						
Central Illinois Chapter	0	0	9	33	0	42
Chicago Section	6 (3 F)	4	125	375	24	534
Cornhusker Chapter	0	0	10	61	0	71
Heart of America Section	0	0	38	82	3	123
Indiana Chapter	0	1	23	66	0	90
Iowa Section	0	0	19	64	1	84
Milwaukee Section	0	1	29	150	1	181
St. Louis Section	0	0	29	165	1	195
Twin City Section	0	0	24	136	3	163
Twin Ports Chapter	0	0	5	23	0	28
NORTHEASTERN REGION						
Connecticut Section	2 (1 F)	2	32	117	3	156
Eastern New York Chapter	3 (1 F)	1	16	51	0	71
New England Section	2	8	74	236	9	320
New York Section	2 (1 F)	12	182	339	18	553
PACIFIC NORTHWEST REGION						
British Columbia Section	0	0	19	48	0	67
Inland Empire Chapter	0	0	5	44	0	49
Oregon Section	1	0	27	66	7	101
Puget Sound Section	0	0	25	84	3	112
Vancouver Island Chapter	0	0	5	22	0	27
SOUTHERN REGION						
Alabama Chapter	0	0	18	45	0	63
Arkansas Chapter	0	0	6	25	0	31
Carolinas Section	0	1	29	77	4	111
Florida Chapter	2 (1 F)	0	17	77	0	96
Georgia Section	0	0	51	89	3	143
Mid-South Chapter	0	0	9	18	70	97
Mississippi Chapter	0	0	6	24	6	36
New Orleans Section	0	0	17	73	0	90
Palmetto Chapter	0	0	10	22	1	33
Southeast Florida Chapter	0	0	8	50	9	67
Tennessee Valley Section	0	0	21	51	2	74
SOUTH PACIFIC COAST REGION						
Mother Lode Chapter	0	0	13	26	0	39
Northern California Section	1	2	62	178	5	248
San Diego Chapter	0	1	27	36	0	64
San Jose Chapter	0	1	9	29	6	45
Southern California Section	1	1	74	212	10	298
SOUTHWESTERN REGION						
Alamo Chapter	0	2	16	55	2	75
Ark-La-Tex Chapter	0	0	9	17	1	27
Oklahoma Chapter	0	0	19	37	1	57
San Jacinto Section	0	0	14	54	2	70
Southwestern Section	0	1	28	96	5	130
Foreign Non-Section	2	1	43	135	7	188
Mexico Chapter	0	0	6	28	1	35
TOTAL	34 (12 F)	78	1,939	5,621	230	7,902

Deceased—The Society records with sorrow the death of two Members Emeritus, 16 Members and 31 Associate Members during the fiscal year.

Members Emeritus

Caldwell, F. C. — Tuck, Davis H.

Members

Ashbee, H. J. — Ingraham, Harry E.
Cady, Cecil I. — Larson, Ludvig C.
Carter, F. M. — Pulver, R. F.
Cornbrooks, C. W. — Schnorbus, W. B.
Gilbert, William M. — Simonsen, S. H.
Gilcher, Ralph J. — Warner, James Paul
Holloway, Elmer A. — White, Cecil K.
Hrabak, Robert A. — Williams, Stuart R.

Associate Members

Benz, Fred D. — McKenzie, Ernest W.
Boffelli, Armando — Meuron, Walter H.
Bouny, Charles — Miller Samuel C.
Bunch, Charles H. — Morin, C. B.
Chamberlin, G. N. — Moynahan, B. John
Cotie, W. M. — Murphy, Willis H.
Cross, Kenneth M. — Niles, R. W.
Curtis, George V. — Pagnini, Lawrence J.
Epstein, H. — Porter, Roland G.
Fraser, S. C. — Schericble, J. F.
Hallamore, J. B. — Von Bergen, Charles A.
Kelsey, Sidney G. — Whitman, Marshall I.
Kemp, Norris — Williams, John H.
Kilburn, C. H. H. — Wissing, Joseph L.
Leesman, Charles J. — Wolcott, F. E.
Wuelker, W. E.

Regional Activities

Committee Program — The program of the ten Regions, and the constituent Sections and Chapters was again guided by the Committee of ten Regional Vice-Presidents headed by R. F. Hartenstein, Vice-President of the Society. The new committee name, replacing Local Activities, was approved by Council at its October meeting. Regular committee meetings were held on the day before Council and the resulting actions were carried out through the visits of the Regional Vice-Presidents with the officers of Sections and Chapters and by extensive correspondence.

Manuals of Guides for Section and Chapter operation were sent to the new Section and Chapter officers early in the summer before the start of the fiscal year. At their regular meetings the Regional Vice-Presidents discussed many matters related to the maintenance and development of the local group programs. The requests for charters received from five petitioning study clubs were reviewed, and after working out boundaries agreeable to all, were recommended for Council approval. The Regional Vice-Presidents assisted in the assembly of the names of locally appointed chairmen to serve in the national programs for membership, publications, public relations and information. They also reviewed all requests for Section and Chapter budget allotments and recommended

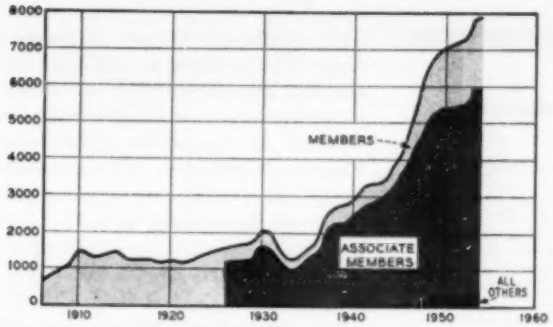


Figure 1. Membership of I.E.S.: Total, Members, Associate Members, all others.

Figure 2. Growth of Sections and Chapters.

these to the National Finance Committee.

Under Society procedure each of the Regional Vice-Presidents organized a Regional Nominating Committee, these selecting candidates for proposal before the National Board and in five instances selecting nominees for election to succeed retiring Regional Vice-Presidents. The Regional Vice-Presidents also assisted in the procedure for submitting candidates for consideration by the Board of Fellows.

In addition to helping with the organization and operation of the Regional Conferences, the Regional Vice-Presidents assisted with the planning of time and place for the Regional Conferences to be held in 1955 and 1956. In addition to the Guide for Operation of Regional Conferences the committee worked up further instructions and materials to help with good Conference operation. All this material was circulated with the Guide to all Regional officers working on the 1954 Conferences.

The committee discussed at length two of the recommendations proposed to Council in June 1953, by the Advance Planning Committee. On these the committee felt that the proposed Regional Conference Committee was not necessary because of the usefulness of the newly assembled Manual of Regional Conference Guides; also that the Regional Conference Papers Committee is not believed desirable at the present time, leaving the initiative and execution of program planning to the local Conference Committee. The committee's report on these was accepted by Council.

The committee also studied the question of the cost of travel by the Regional Vice-Presidents in their visits to Sections and Chapters, this arising from Council's consideration of the Advance Planning Committee Recommendation (#8) that there be provision for such expenses in the national budget.

The proposal that the office of Junior Regional Vice-Presidents be developed to help carry some of the duties of the Regional Vice-Presidents, suggested by President Strong in his Annual Address, was studied, and the committee approved the proposal of Junior Regional Vice-Presidents in Regions where such assistance is desired.

Section and Chapter Programs — The 63 Sections and Chapters of the Society all carried programs of service through local memberships and their committees. According to reports received at headquarters some 482 regular meetings were held during the year, mostly on a monthly basis, with an attendance of members and guests of over 30,000. The scheduling of speakers and subjects for these meetings constituted the most important responsibility of the local groups, since these meetings provide the largest opportunity for direct participation by the membership in the Society program.

A large number of the local groups operated as a regular part of their local program, a study club or technical forum, offering opportunity for the more detailed discussion of the technical aspects of illuminating engineering.

Residence Lighting Forums continue to be an important activity of five of the Society's Sections, Chicago, Georgia, Michigan, New York and Tennessee Valley. Regular monthly meetings were scheduled by most of the Forums, with discussions and demonstrations conducted by their own members and prominent men and women of the lighting industry and allied fields. Trips were made to inspect new homes and remodeled homes.

The New York Section Forum sponsored, for the third year, a lighting Design Competition for students among the New York City Vocational High School students. They also conducted an eight-session course on the principles and current method of residential lighting, planned for decorators, designers, architects, and all who were interested in the home environment, either professionally or as homemakers.

Operating under the revised Guide prepared by the Lighting Service Committee 49 of the Sections and Chapters scheduled "Most Interesting Lighting Job Contests" involving a total of over 200 contestants. Winners in the local contests, which provided unusually fine local programs, went into the Regional Conference competitions.

Instructional courses, together with Lighting Clinics and Conferences, of a day or more, are another important service of the Sections and Chapters to the membership and others who are in the lighting field. During the current year courses under such titles as Illumination Fundamentals, Illumination and Seeing, Illumination Fundamentals and Application, Lighting De-

New Chapters Established by Council Action During 1953-54.

No.	Chartered by Council Action	Name	Headquarters City	Region	Charter Officers
64	Feb. 11, 1954	Ark-La-Tex	Shreveport, La.	Southwestern	R. K. Lothrop, Chairman J. G. Harriss, Secretary
65	April 10, 1954	Virginia	Richmond, Va.	East Central	Jack Downing, Chairman R. T. McCrone, Secretary
66	June 10, 1954	Miami Valley	Dayton, Ohio	Great Lakes	E. J. Rommel, Chairman D. R. Hughes, Jr., Secretary
67	June 10, 1954	Palmetto	Greenville, S. C.	Southern	Roy E. Hallman, Chairman Glen M. Rice, Secretary
68	June 10, 1954	Arkansas	Little Rock, Ark.	Southern	John S. Williams, Chairman Paul F. Cratin, Secretary

sign, Lighting Seminar, were successfully run by a number of Sections and Chapters including New England, Mid-South, New York, Oregon, Georgia, Inland Empire, Heart of America, Pittsburgh and Arizona. Chicago Section continued to maintain its "university" scale operation, in cooperation with the Chicago Lighting Institute, putting on a number of notable lighting clinics during the year. These included Farm and Home Lighting, Maintenance of Lighting Systems, Food Store Lighting, School Lighting, and Filling Station Lighting. A number of other Sections held successful conferences and clinics this year including the Industrial Lighting Forum, by the Michigan Section; the School Lighting Clinic, by the New York Section; the Lighting Clinic, by the Montreal Section; and the Lighting Conference of the Milwaukee Section.

Relations with student groups were well developed this year, Michigan Section holding an illumination seminar for engineering students in Detroit, and at least five Sections running lighting design contests for architectural students. Such contests were reported by Utah Chapter, Northern California Section, Southern California Section, Cleveland Section and New York Section. The Carolinas Section sponsored a panel discussion "Light for Living at Home," as part of the two-day conference of the North Carolina Home Economics Association, and the Northern California Section sponsored a similar activity — a Home Lighting Workshop through the Home Economics Department of the San Francisco State College.

Student Branches — During the year four of the Society's Student Branches continued active and four were inactive. No new Branches were formed during the year. Regular meetings and programs were operated by the following Student Branches with faculty members as shown serving as Branch Advisors:

Oregon State College
D. W. Shirley, Jr.

Southern College of Optometry
O. N. Cole

University of Illinois
J. O. Kraehenbuehl

University of Miami
Jackson S. Sells

New Chapters — Five new Chapters were added to the roster of local Society groups this year not quite matching the record of six set in a number of previous years. The Southern Region led with two new Chapters, one each being added in East Central, Great Lakes and Southwestern. As has been the experience in the past each of these new Chapters developed out of the fine activity of the local representatives and the nearby parent Section. With the approval by Council of these five new Chapters there are now sixty-eight local groups with nine in Canada, 58 in the United States and one in Mexico City.

Regional Conferences — The Inter-Mountain Region formed in 1952 added one to the list of Regional Conferences this year and for the first time in the Society's history nine Regional Conferences were held. A Regional Conference was not scheduled in the East Central Region because of the planning for the National Technical Conference in Atlantic City. All Sections and Chapters cooperated in the organization of the Regional Conferences and there was representation at the Conferences from practically every Section and Chapter of the Society. The Conferences continued to maintain high standards of excellence in their programs and in the performance of the respective Conference Executive Committees. The summary of the Conferences and the principal officers in charge follows:

Canadian Regional Conference, April 28-30, 1954, King Edward Hotel, Toronto, Fred C. Mayberry, Chairman, Canadian National Exhibition Association.

Great Lakes Regional Conference, May 3-4, 1954, Sheraton-Cadillac Hotel, Detroit, A. C. Sangster, Chairman, Detroit Edison Company.

Inter-Mountain Regional Conference, April 15-16, 1954, Brown Palace Hotel, Denver, Harold T. Rankin, Chairman, Public Service Co. of Colorado.

Midwestern Regional Conference, June 17-19, 1954, Jefferson Hotel, St. Louis, Leland M. Wallace, Jr., Chairman, Westinghouse Electric Corp.

Northeastern Regional Conference, May 18, 1954, Schaub's, E. Windsor Hill, Conn., Francis Clark, Chairman, Francis Clark Services, Lighting.

Pacific Northwest Regional Conference, April 22-23, 1954, Benjamin Franklin Hotel, Seattle, K. E. Hollingsworth, Chairman, Puget Sound Power & Light Co.

Southern Regional Conference, April 8-9, 1954, Roosevelt Hotel, New Orleans, S. Conrad Berdon, Chairman, New Orleans Public Service, Inc.

South Pacific Coast Regional Conference, April 19-20, Museum of Art, San Francisco, John S. Walsh, Chairman, Pacific Gas & Electric Co.

Southwestern Regional Conference, April 11-13, 1954, Rice Hotel, Houston, George Trotter, Chairman, General Electric Company.

Local Representatives — With the cooperation of the Regional Vice-Presidents the Sections and Chapters again recommended the appointment of local representatives to carry on the work of the Society in areas not served directly by the local programs of Sections and Chapters. Some of these members have been able to develop especially good programs serving their areas and maintaining interest in the Society.

Operation I.E.S. — An outstanding event in the Society's local programs was this one-day indoctrination session planned by the Chicago's Section to acquaint local officers and committee chairmen with the Society's organization and operation, at the beginning of the fiscal year. Some 60 officers and committee chairmen of the Midwestern Region were present.

Finance

The Committee, with W. Warren Booth, Chairman, continued to discharge its constitutional responsibility for direct supervision of the financial

affairs of the Society. The Committee's work included as usual, the preparation of the operating budget for the year including allotments to all Sections and Chapters based on a careful review of budget requests as recommended by the Regional Vice-Presidents. The Committee also reviewed the financial reports for the 1953 National Technical Conference, recommended approval for the budget submitted to operate the 1954 National Technical Conference and made a number of recommendations to Council on investments and special appropriations.

At the October Council meeting the Committee presented a complete financial report on the project for publishing the Second Edition of the IES Lighting Handbook. The Committee also studied the suggestions of a Past-Chairman, C. C. Keller, that the size of the Finance Committee be increased. This resulted in a report to Council, followed by Society action amending the Constitution to provide for a Committee of at least three members.

A number of special matters were referred to the Committee during the year. The financial implications of the proposed decrease of dues for members outside of the U.S.A. and Canada (Advance Planning Committee Recommendation #9), were studied and reported to Council, following which Council and the membership completed the procedures for implementing the amendment of the Constitution. Another recommendation of the Advance Planning Committee, #8, relative to the transportation expense of national officers, was studied by the Committee as to the amount of funds which would be annually involved. A report on this was likewise submitted to Council.

Following the publication of the auditor's reports on the Society finances, the Committee made a careful study and reported to Council on the Society's financial condition. Studies continued through the year on the subject of life membership including a review of the practice of other engineering societies. A beginning was made on a study of the basic financial structure of the Society, with the examples of other engineering societies also considered.

Minimum Reserve — As reported during the past two years the Committee continued its study of the So-

Statement of Income and Expense for the Year Ending September 30, 1954.

INCOME

Annual Dues		
Fellows	$ 1,020.00	
Members	28,456.75	
Associate Members	72,825.00	
Student Members	1,053.25	
Entrance Fees	2,192.50	$105,547.50
Sustaining Members		40,635.00
Sales, Publications, Gross		
IES Lighting Handbook, 2nd Edition	6,846.05	
Lighting Data Sheets, Binders	3,410.25	
Reprints	12,698.95	
ILLUMINATING ENGINEERING	9,553.29	
National Technical Conference Preprints (1953)	1,265.55	
Membership Roster	12.00	33,787.09
ILLUMINATING ENGINEERING, Advertising		71,283.68
Sales, Badges and Certificates, Gross		523.75
Investments		2,599.43
1954 National Technical Conference Income	11,812.00	
Less: Expense	11,211.32	600.68
Miscellaneous		45.01
TOTAL INCOME		$255,022.14

EXPENSE

General		$ 4,014.09
Office, Business	$ 46,098.36	
Office, Technical	36,938.01	
Office, Publications	40,866.66	123,903.03
Organization, Committees	1,772.41	
Sections and Chapters	26,384.03	
President's Travel	3,000.00	31,156.44
Sales, Badges and Certificates		608.37
Depreciation, Furniture and Fixtures	800.00	
Publications Stock	1,850.48	2,650.48
ILLUMINATING ENGINEERING to Membership		46,281.99
Sales, Publications, Cost of Stock		
IES Lighting Handbook, 2nd Edition	5,127.55	
Lighting Data Sheets, Binders	1,425.06	
Reprints	6,374.44	
ILLUMINATING ENGINEERING	5,324.03	
National Technical Conference Preprints (1953)	1,043.54	19,294.62
Sales, Publications, Stock, Services, Sales and Advertising Promotion		10,840.10
Retirement Pension Plan		5,399.99
Federal Social Security Tax		1,210.00
To I.E.S. Research Fund		5,000.00
TOTAL EXPENSE		250,359.11
NET INCOME		$ 4,663.03

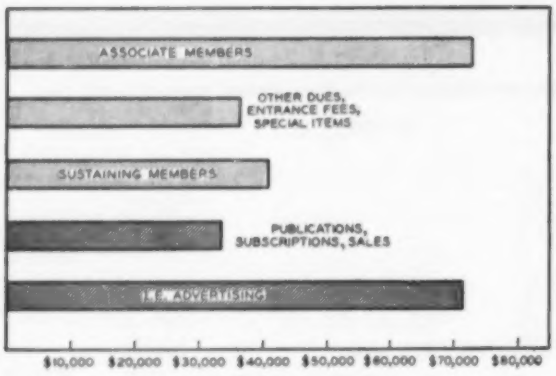
Balance Sheet as of September 30, 1954.

ASSETS

Cash in Banks		$ 44,708.88
Petty Cash Fund		300.00
Accounts Receivable		8,047.04
Investments (Cost)	$ 69,904.38	
Accrued Increment, U. S. Savings Bonds	977.00	70,881.38
Inventories, Publications		19,183.76
Furniture and Fixtures	20,386.65	
Less: Reserve for Depreciation	9,451.66	10,934.99
Deferred Charges to Expense of 1954-55		
Sections and Chapters	3,463.15	
ILLUMINATING ENGINEERING	5,970.33	
General Office Expense	13,556.98	
Moving Expense	2,719.66	25,710.12
Accrued Interest on Investments		60.00
TOTAL ASSETS		$179,826.17

LIABILITIES AND SURPLUS

Liabilities		
Accounts Payable		$ 1,736.84
Deferred Income		
Dues Received in Advance	$ 1,484.18	
Subscriptions Received in Advance	4,563.15	
Conference Preprints (1954)	1,034.51	7,081.84
Surplus		171,007.49
TOTAL LIABILITIES AND SURPLUS		$179,826.17



Total of $255,022 in 1953-1954

Figure 3. The Society's Financial Support.

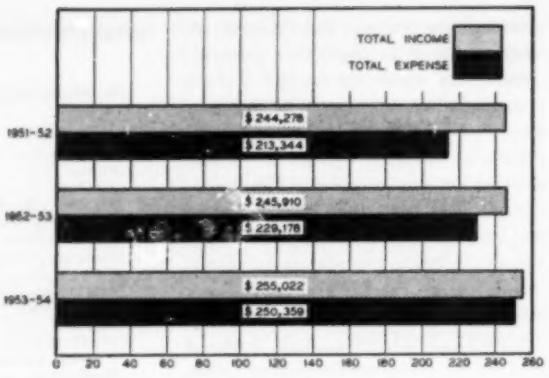


Figure 4. Comparison of income and expense.

ciety's financial reserve situation, and brought to Council its recommendation that the By-Laws be amended to increase the specified minimum. As recorded elsewhere in this report, Council acted upon the required amendment, providing that it shall now be the aim and the policy of the Society to develop and maintain a minimum reserve, in cash and negotiable securities, equal to fifty per cent of current total budgeted annual expenses.

Fiscal Year Statements—The official financial statements for the year are provided by the auditor's report of income and expense, together with the balance sheet. These figures have been converted to chart form to show the Society's principal sources of income (Fig. 3), the cost of the Society's services (Fig. 5), and the comparison of income and expense for the past three years (Fig. 4).

Procedures and Policies

The Committee with Everett M. Strong, Chairman, reviewed Recommendation #11 of the Advance Planning Committee's report as presented to Council in June 1953. Upon the Committee's report of this matter to Council in February, Council acted to adopt the following statement of policy:

> Annual Report to the Membership
> "It shall be the policy of the Society to send annually to the Sustaining Members and generally to all members of the Society a concise printed report highlighting the activities and services of the Society during the year. This is not to be in addition to the publication known as 'I.E.S. Dividends' but such modification thereof as may be appropriate for the extended distribution."

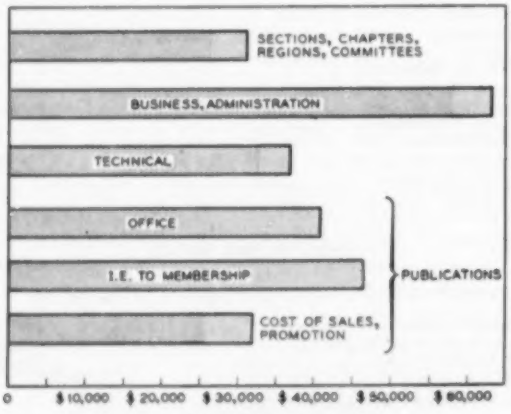
The Committee also recommended a new statement of its scope — "To formulate for Council approval statements of procedure and policy consistent with the Society's Constitution and By-Laws," which was approved by Council.

Constitution and By-Laws

The committee with Walter Sturrock, Chairman, reviewed several amendment proposals, two involving amendment of the Constitution, and one, the amendment of a By-Law. Council letter ballot approved all three proposed amendments, and upon submission to the membership on the national election ballot, the two Constitutional amendments were approved. The three amendments are as follows:

Minimum Reserve (Council actions in Minute 30 (e), 48 (e), 70 (a), 103 (a)) amended By-Law increasing the stated minimum reserve from 25 to 50 per cent:

> *(b) Section 11 (Article VII)* — To provide for security and continued operations of Society activities, it shall be the aim and policy of the Society to develop and maintain a minimum reserve, in cash and negotiable securities equal to fifty per cent of current



Total of $250,359 in 1953-1954

Figure 5. Cost of the Society's Services, 1953-1954.

total budgeted annual expenses. Whenever, at the beginning of any fiscal year, the reserve shall be less than this figure the Committee on Finance in preparing the budget shall, if practicable, include a sum for reserve equivalent to five per cent of the proposed budget.

Finance Committee (Council actions in Minute 30 (f), 48 (c), 70 (b), 103 (b), 173) amended section of Constitution increasing the size of the Finance Committee from three to at least three members:

> *Section 9 (Article VII)* — The President shall, at the first meeting of the Council after he assumes office, appoint, subject to the approval of the Council, the following standing committees: The Executive Committee, a Committee on Finance, of at least three members; a Committee on Papers, etc.

Membership Dues (Council actions in Minute 48 (a), 57, 73, 172) amended section of Constitution decreasing dues for members outside of U.S.A. and Canada:

> *Section 2 (Article IV)* — The annual dues for Associate Members shall be $13.50, for Members $15.00, for Fellows $15.00, for Students $5.00. The annual dues for all grades of individual membership held by persons residing outside of the U.S.A., its possessions, and Canada shall be 50 per cent of the foregoing respective amounts. These dues shall include one subscription to the designated official publication of the Society.

Publications

With J. S. Schuchert, Chairman, the activities of the Committee were aimed to fulfill its responsibility in accordance with its official scope and were carried out by the several subcommittees in cooperation with headquarters, Miss Ruby Redford, Editor of ILLUMINATING ENGINEERING, and Clayton Ellis, Advertising and Sales Promotion Manager. Very satisfactory progress was realized in creating and developing a Publications Committee organization on both a national and a local level. Organization development and financial problems, other general and miscellaneous items are the combined responsibility of the over-all committee and of the staff.

Each local Chapter and Section was requested to organize three local committees, on Papers, Sales and Data Sheets. Many of the Chapters and Sections responded and did an excellent job, considering that this was the first year for this program.

Editorial Content — R. M. Zabel, Chairman — The subcommittee kept in touch with the editorial content as planned for each issue by the Editor.

Changes and Improvements — H. G. Clum, Chairman — Consideration was started as to changes and improvements in publications—format, covers, style, etc. so that none of our publications acquire a routine, stereotyped form and content.

Technical Data Sheets — E. H. Church, Chairman — The expanded data sheet program was very successful. For commercial and industrial data sheets, the quota program (a definite requirement or goal for each Section and Chapter) provided material for an outstanding series of data sheets. With Miss Aileen Page as Chairman, the Residential Data Sheet Program was revitalized and a package of 15 practical, outstanding residential data sheets recently was made available.

I.E.S. Dividends — John Ronayne, Chairman — "I.E.S. Dividends," based on the previous year's activities, was an outstanding illustrated summary of the work of the Society and the benefits accruing to the members, the sustaining members and to the public at large. The preparation and publication of "I.E.S. Dividends" was in the charge of this subcommittee.

Research Brochure—John Ronayne, Chairman — Preliminary thinking was done with respect to the preparation of a research brochure. The subcommittee will follow through on this assignment as soon as certain basic matters and policies are clarified by the Research Fund Trustees.

Sales, Advertising—John Ronayne, Chairman — An organization was created (both national and local) and programs developed to increase the sales and distribution of all publications and thus to realize more fully our dissemination objective. Display kits, individual regional, section and chapter quotas, and many other sales ideas were discussed. Those were adopted which could be handled effectively by our partially developed organization in its first year.

A revised pricing formula covering the selling price of Society publications was developed, recommended, approved and established. Consideration has been given and some plans put into operation for increasing the circulation of our magazine, ILLUMINATING ENGINEERING, not only to fulfill more completely our dissemination responsibility but to make our magazine more attractive to present and potential advertisers. A reprinting of 3,000 copies of the IES Lighting Handbook, including various revisions by the Handbook Committee, was handled by the Publications Committee and staff. 329,316 pieces of material (including the Journal) were published and printed during the past Society year.

Membership Roster—Facts were developed regarding and careful consideration was given to the matter of publishing a membership roster. The

ILLUMINATING ENGINEERING Page Content by Subject Matter

October 1953 to September 1954.

Technical Conference Papers, Including Discussions and Abstracts	251
Technical Committee Reports	30
Other Technical Papers	123
General Secretary's Report	15
Application Articles	117
Data Sheets	54
Questions and Answers on Light Sources	8
Editorials	10
Telecast, Lighting News of Current Interest	128
Lists of Committee Personnel, Officers, and Sustaining Members	29
Advertising	324
Total Pages Published	1089

anticipated need and use did not justify the estimated cost. Further study will be given to the possibility of assembling and binding a mimeographed membership list from each Section and Chapter.

Financial Problems — The Publications Committee advised Council to set up an adequate reserve for possible loss in advertising revenues. Budgets were carefully prepared and planned and working programs were developed to increase income and control expenses—all without any negative effect on the continuance of an outstanding publications program. All of the accounts of the Society involving the Publications Committee indicate that expenses come very close to the financial budget, with revenue from sales considerably ahead of budget.

Representatives to Other Organizations

The Society continued to maintain relations with other associations and agencies in the fields of science, engineering and standardization through the appointment of official representatives. These included 14 members serving on 18 Sectional Committees of the American Standards Association with C. L. Crouch, Technical Director, serving in each case as alternate representative. Official Representatives were also appointed to the following:

American Association for the Advancement of Science, Governing Board
Armed Services N.R.C. Vision Committee
Industry Committee in Connection with the Revision of "Handbook of Interior Wiring Design"
Institute of Traffic Engineers, Joint Committee on Highway Lighting
Inter-Society Color Council
Light's Diamond Jubilee
National Committe on Traffic Safety
National Committee on Uniform Traffic Laws and Ordinances
National Lighting Bureau
National Office Management Association
National Research Council
President's Highway Safety Conference
Society of Motion Picture and Television Engineers
U. S. National Committee of the International Commission on Illumination
U. S. National Committee of the International Elctrotechnical Commission

I.E.S. Research Fund

During the past fiscal year the Society continued its relation with the Trustees of the Illuminating Engineering Research Fund under the provisions of the Trust Agreement. In accordance with these provisions Council approved a list of candidates considered qualified for election as Trustees or as members of the Research Executive Committee, to fill vacancies in the two groups resulting from expiration of terms of office. From these nominations the Trustees acted to complete the Board and the membership of the Research Executive Committee with the following serving for the year:

Board of Trustees

A. F. Wakefield, *Chairman*
Franklin M. Foote, *Treasurer*
Conrad Berens — A. H. Manwaring
Anthony W. Deller — E. M. Strong
Ralph P. Wagner
C. L. Crouch, *Secretary*

Research Executive

Ralph M. Evans, *Chairman*
Willard Allphin — Dean Farnsworth
R. L. Biesele, Jr. — Glenn A. Fry
R. M. Zabel

In presenting the annual report of the Trustees to Council, A. F. Wakefield, Chairman of the Board, outlined the progress on current projects including:

30 and 30 B — Light for Seeing, Dr. H. R. Blackwell, University of Michigan
17 and 43 — Light Free of Glare, Dr. Glenn A Fry, Ohio State University
11 and 11 B — Light for Attractive Color Schemes, Dr. Harry Helson, University of Texas
23 and 23 B — Light for Decrease of Tension, Dr. Leonard Mead, Tufts College
22 and 37 — Light for Highway Accident Reduction, Prof. J. O. Krachenbuehl, University of Illinois; Prof. Dan M. Finch, University of California

The Fund has this year considered six new proposals. One was rejected, two are under contract and active, and three are being processed. Those newly contracted are:

"Angular Light Reflectance of Materia's Used in Offices, Training Quarters, and on Ships" —U. S. Navy Medical Research Laboratory, New London, Connecticut
"Organism's Automatic Motor-Responses to Light"—Massachusetts Institute of Technology

The three being processed include one from Dr. Harry Helson on the effect of the quality of illumination and background color on color preferences; the other two encompass the theoretical and practical phases of improving visibility under fog conditions.

In addition to the publication of Professor Dan Finch's (University of California) progress report on "Instrument for Evaluation of Night Visibility on Highways," (Project #37), ILLUMINATING ENGINEERING (February 1954) also included five papers on light and vision which were related to the work of the Fund. At the National Technical Conference this year Dr. Robert S. Wiseman, University of Illinois (Project #35) presented a paper on "Brightness and Illumination by Interreflections in Enclosures." Extensive efforts are now being made to have available soon a brochure to explain and publicize the Research Fund.

Management

Under the Constitution and By-Laws the Council of the Society is charged with managing the affairs of the Society. The Council consists of the officers of the Society, the two most recent Past-Presidents, six Directors and the ten Regional Vice-Presidents. During the past year the Council held the specified five meetings in alternate months beginning in October, and despite the sizable travel distances for some, made an overall attendance record of 73 per cent. With few exceptions, members of Council unable to be present, were represented by proxies. In the months between Council meetings the management of the Society was carried on by Council's Executive Committee, made up of the Society's five national officers.

The affairs of the Society were carried out through the work of its officers and its committees, to whom various responsibilities were assigned. In all cases, however, the ultimate responsibility resided in the Council, and its decisions from month to month were annually recorded in some 250 pages of minutes.

At each meeting Council (or the Executive Committee) received and acted upon reports of the General Board of Examiners, the Finance Committee, the Committee on Sustaining Membership, the Committee on Regional Activities, and the General Secretary's report on the receipts, expenditures and liquid assets of the Society.

Regular reports were also received on the membership status, especially in respect to the delinquent members. The Council received regularly at each meeting a report on the Society's Technical Committee program presented by C. L. Crouch, Technical Director.

As the work of other standing, general and technical committees was completed, reports of these projects were received by Council, for approval, and in some cases for approval by letter ballot of Council.

As the first of its special tasks, the Council attended the Annual Meeting

of the Society held as is customary in New York on the second Thursday in October. Here a review of the proceedings of the Society was given and Council acted to confirm and approve all the actions of the Society as taken during the previous year.

Two of Council's largest tasks were encountered at its first meeting in October. Here it received the President's recommendation as to the appointment of all committees to serve during the year, and acted upon these. During the past year special attention was given to the scopes of committee assignments, and at the December meeting Council considered and acted upon the approval of statement of scopes for all the Society standing and general committees. The second task in October was in the consideration of a budget for the year, as developed by the Finance Committee and Council Executive Committee jointly during the previous summer months.

The Advance Planning Committee Recommendation #3, as presented to Council in June 1953, and on which an action had been tabled, was again discussed at length during meetings in the current year. The subject "Use of Sustaining Member Dues Income for Projects Outside of Regular Society Operation," was closely related to the statement of Policy adopted by Council in February 1953, as to the single annual solicitation of funds from Sustaining Members. Current discussion of the subject was initiated by Council Executive Committee at its November meeting which included a proposed statement in the Minutes, subsequently approved by the Council, to the effect that "it is the intent of Council that an increasing proportion of Sustaining Membership dues income be allocated to research." A thorough discussion of the tabled action on Recommendation #3 resulted in Council's action at its February meeting to reject it, and refer it back to the Advance Planning Committee for reconsideration.

Another matter which required considerable deliberation by Council, and by Council Executive Committee was the program for certification of industrial and commercial lighting and relighting installations as prepared by the related section of N.E.M.A. Important statements and actions resulted which for the record might best be given in full from the Minute record:

Statement adopted by Council Executive Committee, April 9-10

"The Executive Committee is appreciative of the intention of the National Lighting Bureau to encourage and promote illumination levels recommended by the I.E.S. The Executive Committee is aware of the problems of including lighting quality in a simplified specification which will be practicable for certification by the National Lighting Bureau. Even though such inclusions of lighting quality may not be feasible, the Executive Committee understands and appreciates that it is the intention of the National Lighting Bureau to implement its program by education and training in better standards of quality.

"The present wording of the draft of the Certified Lighting Manual, in the belief of the Executive Committee, could be construed as full endorsement by the I.E.S. of a lighting specification which does not include standards of quality. "Such is not the intent of the I.E.S. Moreover, we understand, it is not the intent of the National Lighting Bureau. Hence, in order to arrive at a mutually acceptable re-wording of the draft, the Executive Committee suggests to President Manwaring that he appoint one or more I.E.S. representatives to work with the National Lighting Bureau for this purpose."

Action of Council, April 10

"To approve subject to the approval of the Council Executive Committee the use in the N.E.M.A. Manual and literature of the name of the Society as a source from whose publications material has been excerpted, and to approve the reproduction by N.E.M.A. of those parts of the Society's Recommended Practices, Reports and IES Lighting Handbook that pertain to footcandle levels."

Action by Council Executive Committee, May 2-3

"The Council Executive Committee considers satisfactory the wording of references to the Illuminating Engineering Society in the second draft of the N.E.M.A. Manual.

"In line with action of Council April 10 (Minute 131) gives approval to the use, in the N.E.M.A. Manual and literature, of the name of the Society as a source from whose publications material has been excerpted, and

"Approves the reproduction by N.E.M.A. of those parts of the Society's Recommended Practices, Reports and IES Lighting Handbook that pertain to footcandle levels."

Official action was taken by Council in connection with the following reports of technical committees, during the year:

Lighting Study Projects in Industry Committee, Subcommittee on Lighting in the Textile Industry — The report "Lighting for Burling and Sewing (Mending)."

Lighting Study Projects in Industry Committee, Subcommittee on Lighting in Saw Mills — The report "Lighting in Saw Mills. Redwood Green Chain Part I."

Residence Lighting Committee — The report "Residence Lighting Resource List."

Progress Committee Report.

Committee on Television Production Lighting —The report "Progress in Television Studio Lighting."

Committee on Testing Procedures — The report "IES General Guide on Photometry."

Committee on Lighting for Civil Defense Report.

Committee on Illumination Performance Recommendations — The report "Classification of Luminaires by Distribution."

Committee on Light Control and Equipment Design — The report "Materials and Finishes for Light Control."

Committee on Office Lighting — The report on the revision of the 1947 Edition of the Recommended Practice of Office Lighting.

Standing Committees

Seven Standing Committees are set up by Constitutional provision and reference has been made earlier in this report to the work of three of these — Council Executive, Finance, and Publications. Reports for the remaining four, follow.

General Board of Examiners

Clifford Miller, Chairman

The Board met monthly throughout the year and carefully reviewed the applications of all desiring election or reinstatement to Member grade. The Board also reviewed all Member grade resignations where there was a possibility of qualifying for election to the grade of Member Emeritus.

Board of Fellows

Arthur A. Brainerd, Chairman

The Board held two meetings during the current year, in December and June. Five of the six Board members

were in attendance at each meeting. In each case the absent member was contacted by phone. Each Board member was supplied with complete information on each nominee well in advance of each meeting. Ten nominations for the Grade of Fellow were approved and forwarded to Council for action at its June meeting.

Medal Award

Walter Sturrock, Chairman

In accordance with the established procedure, the Committee held two meetings to evaluate the eligibility of candidates for the Award. Both meetings, one in January and the other in March, had a full attendance of its nine members. As a result of these meetings it was recommended to Council by unanimous vote of the Committee that Dr. E. F. Lowry be awarded the 1954 I.E.S. Gold Medal.

Papers

R. M. Zabel, Chairman

In planning the technical sessions for the 1954 National Technical Conference, the Committee reviewed some 50 papers in outline. With the object of limiting the number of technical papers to provide ample time for discussion, only 23 of the papers in outline were accepted. Manuscripts for 23 of these were received in time for review and were approved for setting in type as Conference preprints. Papers were grouped for session presentation and discussion was organized by those appointed for the purpose. The three papers in the first technical session were by invitation; they were:

The Acoustic Environment
Robert B. Newman—Consulting Engineer
Bolt Beranek and Newman, Inc., Cambridge, Mass.

The Thermal Environment
Nathaniel Glickman—Consulting Engineer
Miami Beach, Florida

The Luminous Environment
L. C. Kalff, N. V. Philips Gloeilampenfabrieken, Eindhoven, Netherlands

The Committee also arranged for several papers in the general area of Standards of Quality and Quantity for Interior Illumination, with the cooperation of the Society's technical committee on that subject, and likewise scheduled a symposium of Lighting for Civil Defense.

General Committees

The 15 General Committees of the Society are charged with all the operating functions not handled by the Standing Committees, and not pertaining to the preparation of reports on scientific and engineering subjects. The work of three of these has been given in the preliminary part of this report—Procedures and Policies, Constitution and By-Laws, and Regional Activities. Reports for the balance of the General Committees, follow.

Advance Planning

C. C. Keller, Chairman

Since presentation of its extensive report to the Council in June 1953 the Committee has had no meetings but has furthered its deliberations on related subjects by correspondence.

Advisory Board on Committee Personnel

D. M. Jones, Chairman

This Board gave considerable assistance to the President in planning Committee personnel to serve in the succeeding administration.

Board of Nomination

Walter Sturrock, Chairman

In accordance with the Constitutional provisions and following the procedure adopted by Council the Board was formed with the three Past Presidents of the Society and representatives of each of the 10 Regions. The Board reviewed extensive records of candidates as submitted by the respective Regional Nominating Committees, and from these prepared a nomination ticket containing names of those deemed best suited to serve as officers and directors in the positions to be filled in the ensuing election.

Defense Coordinating

A. F. Wakefield, G. D. Mills, Co-Chairmen

The Committee held one meeting during the year. Most of the activities have been carried on by correspondence. A current report on the Projects follows:

#2—Artificial Moonlight. Project has been completed. Final report filed with the Technical Director, inasmuch as the report was Classified by the Army.

#3—National Research Council contact has been inactive.

#4—I.E.S. Committee on Lighting for Civil Defense continues to function.

#7—Message to the Enemy in Psychological Warfare Project remains Classified.

#9—Coordination with Aviation Lighting Committee continues.

#11—Research and Development Board contact has been inactive.

#12—I.E.S. Searchlight Committee completed its second year.

#13—U. S. Naval New London Submarine Base, Medical Research Laboratory cooperative activity with I.E.S. Research Project #15.

#14—Illumination and Color Standards for the Conservation of Vision—Air Force.

There has been no active solicitation for the expansion of the Committee's work during the past year, but the members of the Committee stand in readiness to support the offer made by the Society from time to time to the Armed Services and the various Defense agencies.

Historical

S. G. Hibben, Chairman

The Committee prepared, and had published in the July 1954 issue of "The General Electric Review" a condensed history of the Society. One of a series, this three-page story records chiefly the establishment of the organization, and its expanding growth and influences.

Work continues on the final draft of the history of our Society's first decade; on the 50-year record that is being planned for the 1956 Golden Anniversary year; and on the book material—collected but not consolidated—that is to present the historical record of this half-century of the lighting fixture business.

Several additions were made to the library; some records supplied to the Diamond Jubilee headquarters, and two more of the Past-Presidents' remarks prepared for disc recording.

Lighting Service

L. E. Tayler, Chairman

The Committee again made its principal activity the organization and operation of the Most Interesting Lighting Job Contests at the local, regional and national level. Based on the experiences of the previous year a number of changes were made in the Guide for the Contests. Council acted to approve an appropriation in the general budget covering prizes in the local as well as in the national contest. With a good start on the activity 49 of the Society's 63 Sections and Chapters indicated plans for holding local contents and these involved a total of over 200 contestants.

Following conference with the Regional Activities Committee the Committee designed and prepared for all contests suitable certificates which could be presented to the winners with their cash prizes. The program of the

Lighting Service Forum held in conjunction with the technical sessions of the National Technical Conference consisted of the competition among the winners representing the ten regions. The winners, to whom prizes and certificates were presented at the Conference Banquet were:

First Prize, Floyd Sell and Duncan Preston, Michigan Section.

Second Prize, J. J. Tynan, Philadelphia Section.

Third Prize, Louis N. Goodman, New Orleans Section.

Fourth Prize, Eric Ackland, British Columbia Section.

Membership

T. W. Lauer, Chairman

The organization of the membership activity continued in the pattern of the past two years with Sections and Chapters divided into four groups of comparable size. Gains were evaluated in per cent of the October 1st membership, excluding student membership, with elections as well as losses due to resignation and dropping considered. Assistance was given the local committees through ample supplies of application forms, a membership promotion folder, as well as a list of architect prospects, who had purchased copies of the IES Lighting Handbook in recent years. Monthly reports showing the standing in the campaign were sent all local and national officers. The winners in the four groups receiving the prize checks at the National Technical Conference in Atlantic City were:

Group I—Michigan Section (first)
New York Section (second)
Group II—Capital Section (first)
Toronto Section (second)
Group III—Arizona Chapter (first)
Tennessee Valley Section (second)
Group IV—San Diego Chapter (first)
Utah Chapter (second)

National Technical Conference

Charles N. Laupp, Chairman

The Committee reviewed the plans and budget for the Conference in Atlantic City, September 13-17, and recommended on these to Council. The Conference included observance of Light's Diamond Jubilee as well as a distinctive presentation of the Progress Report — contrasting the lighting of the past with that of the present. Consideration was given to some of the planning for the 1955 Conference to be held in Cleveland.

Conference Registration Records.

1944	Chicago, Illinois	721
1945	No Convention	.....
1946	Quebec, Quebec	807
1947	New Orleans, Louisiana	605
1948	Boston, Massachusetts	906
1949	French Lick, Indiana	668
1950	Pasadena, California	556
1951	Washington, D. C.	765
1952	Chicago, Illinois	859
1953	New York, New York	1,007
1954	Atlantic City, New Jersey	851

Public Relations and Information

J. F. Whitehead, Jr., Chairman

The Committee carried out an extensive program under the general plan adopted in 1949, with attention to internal relation with the Society membership as well as external to the lighting and electrical industry and to the public. The activity has been carried on by headquarters personnel at the national level and in practically every Section and Chapter at the local level. Each local committee was again equipped with a manual of instructional and publicity material.

The principal effort toward the membership is the series of President's News Letters this year sent on four occasions to over 1000 local and national officers and committee chairmen. Following the production of the excellent brochure I.E.S. Dividends by a Subcommittee of the Publications Committee, wide distribution was given to this dramatic presentation of the Society's program. Press releases at the local and national level, as well as at the Regional Conferences are the principal means for external publicity. The Guide for Publicity at Regional Conferences was again circulated together with special material for publicity incident to the President's Address.

Residence Lighting Forums

Katharine T. Goodall, Chairman

The principal work of the Committee consisted of the planning and operation of the Residence Lighting Forum Session at Atlantic City, presented in conjunction with the National Technical Conference. This was a group presentation "New Light on Modern Living," given by three prominent designers. The Committee also reported the continued activity of five Residence Lighting Forums in connection with Sections of the Society at Chicago, Atlanta, Detroit, New York and Nashville.

Sustaining Membership

C. C. Shotwell, Chairman

The Committee organized early in the fiscal year to provide a maximum of help to the respective committees in all the Sections and Chapters. Together with the Society's Official Procedure and Policies for Election and Maintenance of Sustaining Members, a complete file of aids was sent each local committee chairman to assist him in his activity. A number of letters were sent to the local committees and in December the National Committee proposed, as an objective for the year, the achievement of a "quota" of new elections or increases in support from present members. Several Sections made an excellent response to this challenge with results as follows:

Group I

	Quota	Elections & Increases	% of Quota
Chicago	6	7	117%
New York	6	5	83%
Southern California	6	1	17%
New England	6	1	17%
(and 4 Sections)		0	

Group II

Toronto	4	5	125%
Eastern Pennsylvania	4	1	25%
Montreal	4	1	25%
(and 13 Sections and Chapters)		0	

Group III

Rochester	3	1	33%
(and 23 Sections and Chapters)		0	

Group IV

Fifteen Chapters	2	0	

On a number of occasions the Chairman invited the help of Council members and especially the Regional Vice-Presidents in assisting and stimulating the local committees in their program.

Efforts continued toward keeping the Sustaining Members informed as to the Society's program. The President's News Letter was sent each Official Representative, on four occasions during the year, and a special letter over the President's signature accompanied the mailing of the new brochure I.E.S. Dividends to each member.

Considerable study was given to the policy adopted by the Society in February 1953 covering the single annual solicitation of Sustaining Members for the support of the over-all operations of the Society, including research. The Committee also assisted in moving along the planning for the descriptive report with appropriate emphasis on

research, to be used in the annual solicitation.

Adjusting business conditions in certain parts of the industry resulted in the loss of some Sustaining Members, thus offsetting the gains enrolled by the good efforts of the local committees. The over-all results are shown below.

Sustaining Members for Past Seven Years.

	Members	Dues Income
1948	326	$30,209.37
1949	315	40,335.00
1950	316	40,235.00
1951	316	40,793.00
1952	335	41,735.00
1953	334	40,735.00
1954	336	40,635.00

Tellers

Kenneth E. Ferree, Chairman

In accordance with Constitutional provisions the Committee met following the close of the election ballot and counted the vote both on the national and Section offices. In this the Committee had the customary assistance of headquarters personnel both in the preparation of the forms and reports, as well as in the opening of the ballots and making of a preliminary count.

Task Committees

Joint I.E.S.-U. S. Public Health Service

J. F. Parsons, Chairman

The assigned project of this committee, the preparation of material for a publication "How to Make an Eye Conservation Survey" was completed in November 1952. The project was originally undertaken at the request of the U. S. Public Health Service and was intended for use primarily by field engineers of that organization as an aid in promoting realization of the importance of proper visual environments in the contacts of their representatives with Federal, State and Municipal authorities, and with private industry. During the past year the committee has continued to secure reactions of medical and health groups on its draft report.

Light's Diamond Jubilee

S. G. Hibben, Chairman

The Committee has been in constant touch with the Jubilee headquarters, and has held several short meetings with the advertising agency, chiefly to edit the "Fact Book," and similar literature. The chairman attended all but one of the Society's Regional Conferences, speaking on the general programs and activities.

Numerous designs and decorative lighting sketches were prepared for publication, or for suggestion to utility groups. Considerable assistance was given to committees of the Edison Electric Institute, as special lighting features for its June Convention, Atlantic City, and several programs combined for similar meetings.

The Chicago Lighting Institute and such public educational organizations as may be centers for popular lectures, etc., were visited in the interest of organizing Jubilee programs. A list was prepared of the significant light sources of the electrical era, and substantial help given to the Jubilee film and radio scripts.

Technical Committees

The Constitution provides for the establishment of technical committees to report upon scientific and engineering subjects. The technical committee activity was overseen by Duncan M. Jones, Senior Vice-President, who was active in counseling and in following progress. The work was carried out by C. L. Crouch, Technical Director, and his capable associates at headquarters. Scheduled again this year was a two-day Technical Forum bringing together for a most successful meeting the chairmen of all technical committees. The forum proved to be a profitable interchange of committee experience, problems and planning, also serving as an excellent orientation for both old and new chairmen. Reports of the several committees on the 1953-1954 program follow.

Aviation Lighting

D. C. Miller, Chairman

Early in the year the Committee held a two-day conference type of meeting in Washington, D. C. at which prepared papers on lighting of helioports, helicopters, instrument dials, aircraft interiors, approach runways and aircraft marking were presented. The conference was highlighted by a panel discussion of research and development work by both government, public institutions and private industry.

A number of executive subcommittee meetings were held and another conference type meeting was held in Milwaukee in April. This conference was held in conjunction with the Lighting and Marking Panel (Government Services) and NEMA Aviation Ground Lighting Section. Papers were presented which were concerned with aircraft position lights, electro-luminescence for aircraft console lighting, aircraft exterior lighting system and helioport lighting. Subcommittees which were active during the year reported on the following at the conference meeting — definitions and terms, approach lighting, airport apron and ramp lighting, aircraft lighting, and airport lighting.

Civil Defense, Lighting for

J. W. Bateman, J. C. Forbes, Co-Chairmen

As a result of earlier conferences with the Committee representatives of the Secretary of Defense and of the Federal Civil Defense appeared before the June meeting of Council. These representatives outlined the history of the planning and efforts during and since World War II in the problems of illumination control for defense emergencies. At the same meeting Council also approved the Committee's report and recommendations which included the following:

(1) Initial phases of work of technical consultants to the Secretary of Defense are completed.

(2) Suggestion that technical consultants subcommittees not be re-appointed in the coming year.

(3) Appointment of new technical subcommittee to develop material for technical booklet as requested by the Federal Civil Defense Administration.

(4) Utilization of I.E.S. Regional Vice-President channels to obtain names of qualified technical consultants from designated lighting control areas. These names to be submitted to Federal Civil Defense Administration for possible appointment by State Civil Defense Directors to their staffs.

(5) Secretary of Defense to use name of Illuminating Engineering Society in first public announcement of the plan for control of illumination.

Color and Illumination

J. A. Meacham, Chairman

The Committee has continued in 1953-54 the work initiated in the preceding year, which was a study of the following three questions:

(1) The Proper Scope of the Illuminating Engineer with respect to the field of color specification and decoration.

(2) The Effect of Color on Vision.

(3) Guiding Principles in the Use of Color.

Three subcommittees have continued their investigation of the above questions and have submitted their reports. These have been incorporated in an Interim Report. An initial draft of the Interim Report has been circulated among the members of the Committee, and ballots have been returned. The revised Interim Report is being submitted to Council and does not cover completely the original objectives of the Committee on Color and Illumination — particularly with respect to Section 3.—Guiding Principles in the Use of Color — there is more work to be done by the Committee in this field.

Daylighting

R. A. Miller, Chairman

The Committee reports progress as follows on its principal items.

(1) A session on Daylighting was held at the 1953 National Technical Conference in New York. At this session the use of daylight from overhead diffusing and selecting glass fenestrations and the design and use of plastic domes were presented by members of the Committee. All three papers were published in the April 1954 ILLUMINATING ENGINEERING.

(2) The Daylighting Committee met at the New York session and discussed three principal items.

(a) A report was given by Dr. Vezey on methods which are applicable for daylight surveys. It was pointed out that two illumination meters may be used to perform surveys on the basis of total daylight factors. The results are largely independent of sky conditions and may be used for comparison purposes. A separation of ground reflected and sky daylight may be used to provide the components contributed when light contributed by the ground is a part of the design. This work was later published under the title of "Daylight Survey Methods" by Messrs. Vezey, Reed and Evans.

(b) A discussion of the history of the Ohio State Code was presented to the Committee as an example of the development of a performance type code to supplant the more obsolescent codes which have been in existence in Ohio, as well as many other states, for many years.

(c) A presentation of types of data which are being recorded by the U. S. Weather Bureau was made to the Committee in order to acquaint the Committee with such meteorological data as is being made available to the industry. It was pointed out that the Weather Bureau is desirous of obtaining comments from possible users of these data as to the adequacy of measurements which are being taken and the desirability of obtaining additional types of data.

(3) Through liaison with the Office Lighting Committee, the progress of that Committee on comfort evaluation and reflected glare was circulated for comment in order to better inform the Office Lighting Committee of the views of the membership of the Daylighting Committee on these subjects.

Farm Lighting

O. C. Lange, Chairman

During the 1953-54 year the Committee had two meetings — the first meeting was held in Washington, D. C. on May 19th and 20th. At this meeting it was proposed to send the booklet, "Recommended Practice for Residence Lighting," to State Extension Heads as well as pertinent government personnel. A list of 107 names was prepared and the booklet was mailed to these persons during the month of September. During this meeting in Washington, the Committee made a tour of the Agricultural Research Center at Beltsville, and observed the research being conducted on the effects of lighting on plants, animals and farm products.

A second meeting was held in Pittsburgh where the Committee met with representatives of the Industrial Committee on Interior Wiring Design for the purpose of incorporating the Committee's suggestions on farm lighting in the Revision of the Farmstead Wiring Booklet. The Committee made many suggestions for the booklet which it is believed will considerably improve the recommended lighting outlet layout for the farmstead.

IES-ASHVE Joint Committee

Walter Sturrock, Chairman

From the many possible cooperative activities the Committee this year selected as its principal project the interchange of available technical material between the two Societies. This work involved the solicitation of questions on light and lighting from the ASHVE group and similar questions on air conditioning from the IES group. Answers to these questions have been prepared and will be released for publication as soon as proper approvals can be obtained.

Illumination Performance Recommendations

Benjamin S. Benson, Jr., Chairman

The scope of this Committee was to prepare illumination performance recommendations for luminaires conforming to C.I.E. classifications, excluding residential.

Continuing with the work of previous years, this Committee has given much serious consideration to a classification of luminaires by use. In each use classification would occur certain maximum (true or average) brightness limitations with corresponding minimum light-output-efficiency values. The present Committee has concluded, as reflected in the work of the past Committees, that a singular lack of knowledge exists in the Society in regard to brightness and its effect upon comfort and disability. In view of this conclusion the Committee is recommending to the I.E.S. Research Fund that a grant be made to a suitable institution of learning for a basic study of this problem.

The Committee has completed work on a much needed classification of direct and semi-direct luminaires by distribution. This classification system has been in study for several years and is offered as a simple and reasonable method.

Industrial Lighting

James R. Chambers, Chairman

The Committee functioned principally by correspondence and held one meeting to review the progress of all the industrial lighting projects throughout the country. Members of the committee served as coordinators to follow the progress of each of the Study Subcommittees. These included:

Lighting of Central Station Properties—L. G. Parks, Chairman. This Committee held three meetings during the past year. Work was completed on the High Bay Area report and also on the Outdoor Area Report. The miscellaneous Interior Area Report is being pushed aggressively.

Lighting in Steel Mills—A. Paulus, Chairman. The Steel Committee is currently working on the lighting of blast furnace areas.

Lighting in Sheet Metal, Stamping, Folding and Shearing Industry—Floyd W. Sell, Chairman. Lighting progress is being made in this segment of industry. Lights are being installed on presses. The press manufacturer is aware of the seeing problem and is providing the space and facilities for lighting fixtures. Attempts are being made to improve the performance of current fixtures.

Lighting for the Graphic Arts—Printing Industries—R. R. Enghouser, Chairman. This Committee has had six meetings during the past year and has quite a bit of data gathered on color processes which are ready for study.

Lighting in the Clothing Industry—N. T. Kridel, Chairman. The Committee is running visibility meter measurements on critical tasks.

Lighting for Saw Mills—James E. Barnes, Chairman. This Committee has submitted its report "Redwood Green Chain—Part II" for publication, and the Industrial Lighting Committee voted it acceptable. The Committee is now combining this material with Part I (approved by Council in October 1953) to make one composite report for publication and use in the field.

Lighting in the Textile Industry (Joint Committee with A.S.M.E.)—W. L. Kelley, Chairman. A third addendum to the 1949 woolen mill lighting report was published in January 1954 entitled, "Lighting for Burling and Sewing (Mending)." The Committee has been studying three additional textile mill processes: Lace making, weaving of narrow fabrics, carpets.

Mine Lighting—C. M. Crysler, Chairman. The major activity was a meeting in February held at Fairmont, West Virginia, and included a field trip to the Owens Mine of the Consolidation Coal Company, where approximately 200 fluorescent units were operating in accordance with previous recommendations of our committee. Also a special floodlight was installed on the cutting machine which improved the face illumination. As a result of this field trip, recommendations have been submitted to interested parties for experimental fluorescent units more nearly meeting the rugged requirements of underground lighting. The Subcommittee on Measurements under R. Eastman, Chairman, made complete brightness, visibility and footcandle measurements of this installation.

The Committee is next planning to conduct further tests underground with improved fixtures, which are being built and designed from previous experience.

Lighting in Laundries—O. A. Hill, Jr., Chairman. The principal activities of the Committee during the past year have consisted of maintenance and depreciation studies at the American Institute of Laundering in Joliet.

Lighting in the Petroleum Industry—D. H. Watt, Chairman. The newly organized Lighting in the Petroleum Industry has prepared its organizational program and has submitted its purposes and methods of operation. Concerted effort was directed toward interesting the American Petroleum Institute in operating on a joint basis in this illumination study. This Committee has prepared a flow chart of the Oil Industry and has split up the project of studying lighting in the petroleum industry by designating certain segments in this flow-chart to specific committee members.

Institutional Lighting

James H. McCulloch, Chairman

The new name of the Committee replaced the previous title "Committee on Lighting Study Projects in Public Buildings and Private Institutions." One Committee meeting was held with reports from Subcommittees as follows:

Lighting in Hotels—C. I. Sayles, Chairman. Preparation of bulletin on hotel lighting for joint distribution by American Hotel Association and the Illuminating Engineering Society. Preliminary editing done and photographs selected.

Lighting in Kitchens, Lunchrooms, Cafeterias, and Dining Areas—Carl Zersen, Chairman. Compilation of recommendations for lighting these areas; draft in hands of Subcommittee for final approval.

Lighting in Hospitals—W. H. Smith, Chairman. Material on emergency lighting, on hospital, kitchen and laundry and on patient's room lighting is in preparation. A compilation of existing standards of UL, ASA, NEC, and NBFU is planned.

Theater Lighting. Inactive. Will be reorganized for coming year.

Church Lighting. Inactive. Will be reorganized for coming year.

Light Control and Equipment Design

David L. Williams, Chairman

The Committee reports that it has prepared a tabulated guide which will be known as "Table of Materials and Finishes for Light Control" in which the commonly used metals, plastics, glasses, and applied coatings are tabulated with their pertinent engineering characteristics. This guide and its accompanying report were submitted at the June meeting of Council.

Light Sources

H. F. Davidson, Chairman

This Committee held three meetings during the year, in January, May and September. The Committee continued to prepare for publication, in ILLUMINATING ENGINEERING, the Questions and Answers page on light sources. This activity was started in 1951 as a means of answering specific questions on light sources and at the same time making the information available to the membership of the Society.

The Committee has commenced work

on a report dealing with the effects of high and low ambient temperature and drafts on the light output, starting and color of fluorescent lamps.

The Subcommittee on Color Rendition of Light Sources continued its important work of establishing a method of mensuring and specifying the color rendition properties of light sources.

Lighting Design Practice

J. Roy Jones, Chairman

The Committee assignment is to study and make recommendations concerning the method of making lighting calculations. The following progress is reported.

A report was submitted to Council at its October meeting recommending that the Zonal Interflectance method be adopted as the preferred I.E.S. method of calculating coefficients of utilization. In this report it was further recommended that the data for calculating coefficients of utilization be made available for a wide range of room surface reflectances; and specified reflectance combinations were recommended for use where an abridgement was desired.

The Committee is continuing to study methods of calculating coefficients of utilization particularly with respect to simplifying the Zonal Interflectance method. The Committee is also studying methods of classifying rooms according to shape of room ratios.

Lighting Education

H. H. Magdsick, Chairman

The Subcommittee on Employment Potential for Professionally Trained Illuminating Engineers, William Foulks, Chairman, has completed a survey of thirteen categories of employers. Responses received from organizations presently employing 3600 people on lighting activities — 2100 of them technically trained — reported a need for about 350 new people with technical training in illuminating engineering during the next year, and approximately 1200 in the next five years.

Information obtained in the survey on functions the lighting personnel are expected to perform and specific training desired is now being studied by the Subcommittee on Curriculum, Dr. Leland H. Brown, Chairman, for its implications with respect to academic programs to serve the lighting field.

The Subcommittee on Revision of the Society's Brochure "Experiments with Light," A. A. Eastman, Chairman, has completed a first draft of a proposed new text for study by the Committee as a whole.

Lighting Maintenance

R. F. Townsend, Chairman

The following progress was made toward Committee objectives during the year 1953-54:

(1) Based on the results and analysis of six months test data, the Dirtometer has been redesigned and new models are now in the hands of Committee members for new dirt collection tests. The new design is capable of gathering both reflectance and transmission data. A revised instruction sheet and field sheet for recording data has also been issued.

(2) A Subcommittee under the direction of R. P. Teele has been established to improve the Dirtometer design.

(3) A Subcommittee under the direction of E. H. Church has been established to investigate the design of a standard dust chamber to provide accelerated atmospheric conditions.

Motor Vehicle (Exterior) Lighting

Ray P. Teele, Chairman

The Society had a Committee on Motor Vehicle Lighting from 1917 to 1943. In 1953 a new Motor Vehicle (Exterior) Lighting Committee was formed. The scope of this new committee is different in one important respect from that of its predecessor; it is no longer charged with preparation of detailed specifications for lighting devices, this function being capably performed by the Society of Automotive Engineers.

There are three groups working on related problems, the SAE, the National Committee on Uniform Traffic Laws and Ordinances, and the Defense Department. All three of these bodies are getting out final recommendations which this Committee needs to be cognizant of in its work. The SAE specifications were revised to include an improved sealed-beam automotive headlamp; the National Committee on Uniform Traffic Laws and Ordinances was revising the Uniform Code; the Federal Civil Defense Administration was preparing a "Plan for Illumination Control in the Defense of the Continental United States."

The revisions of the Uniform Code were adopted in June this year and the FCDA "Plan" was released early in July. With these documents and the SAE specification the Motor Vehicle (Exterior) Lighting Committee can now proceed to formulate the principles of proper illumination in this field and make recommendations leading to the proper carrying out of these principles.

Nomenclature

D. M. Finch, Chairman

The Committee has held two meetings during the past year, one in New York in September, and one in New York in January. The group is widely dispersed throughout the United States making attendance at committee meetings very difficult. As a consequence most of the business has to be transacted by correspondence. In spite of difficulties, tentative agreement was reached at the January meeting on the method of handling the controversial terms relating to brightness. The discussions are being translated into definitions and should make possible the clarification of these quantities in the basic nomenclature.

In addition to the domestic work the committee has been participating in the international work of the C.I.E. Several of the U. S. committeemen, including the chairman, are also in the international nomenclature, vocabulary and standards committees. The international group meets in June 1955 and has been active for many months in preparing its report and recommendations. The international activities have been quite time consuming and have taken up a disproportionate amount of the committee's time, but it is felt that this is a worth while endeavor and should be continued.

Office Lighting

John J. Neidhart, Chairman

The Committee completed its revision of the Recommended Practice of Office Lighting and submitted it to

Council at its June meeting. The revision was accepted for Council's letter ballot with two provisions. The first of these provisions requested that the Committee again review the suggestions of one of the Committee members who cast a dissenting vote. The second provision requested that the School Lighting Committee give prompt study to the comfort provision in the Office Lighting Committee report and either adopt those provisions or arrive at modifications mutually acceptable to the two Committees.

Progress

E. W. Beggs, Chairman

The Committee maintained contact with the art of lighting throughout the world and prepared the yearly review of the achievements in the art of lighting for publication in ILLUMINATING ENGINEERING. This review was given a dramatic presentation as one of the features of the 1954 Atlantic City National Technical Conference.

Protective Lighting

J. W. Lee, Chairman

The Committee is awaiting approval of its report the American Standard "Protective Lighting for Industrial Properties A-85, 1952."

Public Conveyances—Interior Lighting

C. E. Egeler, Chairman

The Subcommittee on Interior Lighting for Buses, Trolley and Railroad Cars has under preparation, in cooperation with representatives of the Electrical Section of the Association of American Railroads, a revision of the Lighting Section of the A.A.R. Manual. A principal objective involving detailed discussion at three meetings of the committee held during the year, has been the formulation of more detailed data, which could be easily applied as a guide to the latest designs for the lighting of railroad car interiors.

The Marine Lighting Subcommittee has nearly completed in draft form, a Recommended Practice for Marine Lighting, which will be the first comprehensive guide to be made available for marine architects, ship builders, lighting equipment manufacturers and others interested in the lighting of merchant marine vessels. Comments and criticisms of the material are now being studied.

Research

Willard Allphin, Chairman

The Committee has conducted a survey of all colleges and universities in the United States to determine interest in research on light and vision and what projects are under way at each institution.

Replies are being tabulated and have been analyzed to determine

(1) Those who are not doing light and vision research but wish to receive the Committee report.

(2) Those who report completed projects.

(3) Those who report pending projects.

(4) Those who propose projects and the projects involved.

Residence Lighting

Norman H. Vacha, Chairman

The Committee engaged in a full and active work year with alert and spirited participation on the part of the members of this Committee, in the three one-day and one two-day meetings.

Two projects carried over from last year were completed.

(1) Residence Lighting Resource List. This report was published and copies mailed to all known home economics departments.

(2) Allied Arts Competition on Home Design: A Subcommittee under the chairmanship of K. A. Staley prepared a full and complete prospectus with a guide of operations. This was referred to the Regional Activities Committee.

(3) The Committee helped to organize a half-day parallel session at the National Technical Conference in Atlantic City involving successful collaboration with allied societies.

(4) The limiting scope of the Technical Residence Lighting Committee was broadened to incorporate a training program.

(5) A Residence Lighting Coordinating Committee was formed to suggest unified programs, furnish information and assist in performing the duties for which these following Committees exist:

Residence Lighting Committee

Residence Lighting Forum Committee

Subcommittee of the Publications Committee on Home Lighting Data Sheets.

(6) The results of the Dormitory Study Room Survey are being studied as a basis for a report on dormitory lighting.

School Lighting

J. M. Chorlton, Chairman

During the year the Committee followed the progress of the Office Lighting Committee closely as it relates to the provisions for luminaire comfort acceptability. It set up an activity to study and report on low ceiling classrooms. Several meetings were held for planning the revision of the 1948 edition of the American Standard Practice of School Lighting. These meetings included the School Committee of the American Institute of Architects, which co-sponsors the Standard Practice with the Society under the Sectional Committee method of the American Standards Association. Following approval by Council at its December meeting, the National Council of Schoolhouse Construction was added as a co-sponsor for the Standard Practice, and a delegation from this organization attended the final meeting devoted to planning the revision. Subcommittees which were active during the year included those appointed for Bibliography of School Lighting, Chalkboards, Electrical Lighting Design, Student Vision and Scholarship, and Visual Problems.

Searchlight

Theodore H. Projector, Chairman

Two meetings of the Committee have been held, the first in January, in Washington, the second in June, in New York. William H. Smith designated as Secretary, Subcommittees have been set up as follows, with Chairmen as indicated: Auxiliaries, H. N. McIntyre; Bibliography, J. P. Latil; Light Sources, J. Bartelt; Nomenclature, E. Boghosian; Optics, D. Peterson; Testing Procedures, T. Monahan; Visibility of Light Sources, W. A. Pennow; Visibility of Targets, A. H. Clarke; Executive, T. H. Projector.

The Bibliography Subcommittee has assembled a comprehensive list of books and articles in the field of searchlights and is arranging to extend its references and keep them up to date. The other Subcommittees have begun work in their respective areas.

Signal Lighting, Elements of

F. C. Breckenridge, Chairman

Further progress has been made with the preparation of manuscripts for the Elements of Signal Lighting, notably by C. A. Douglas who has his copy for Part 4 more than 50 per cent completed. This includes the preparation of several nomographs and the most difficult portion of the text. Messrs. Blackwell and Harrison have submitted outlines. Manuscripts by Messrs. Middleton and Forsythe are still awaiting the complementary chapters which will permit the publication of two additional parts.

Sports and Recreational Area Lighting

Merle E. Keck, Chairman

The work of this Committee was carried on principally by correspondence and included the review of a draft of a proposed addendum to the Recommended Practice for Sports Lighting covering eighteen additional minor sports.

Standards of Quality and Quantity for Interior Illumination

Sylvester K. Guth, Chairman

A draft of a report tentatively titled "Permissible Brightness of Lighting Equipment — with Special Reference to Comfort" has been circulated to members of the Committee. The purpose of this report is to revise and bring up to date those portions of report No. 1, "Brightness and Brightness Ratios" which deal with this part of the problem.

At their suggestion, several of the scientific members of the Committee have been appointed to an advisory subcommittee. They felt that their services could be used to better advantage if they were more or less freed of committee activities dealing with lighting practice. The function of this subcommittee is to review, analyze and evaluate the available information on visual performance and visual comfort. It will provide the main committee with the basic material for the preparation of reports for the lighting practice committees.

Store Lighting

R. C. Allison, Chairman

The Committee held three meetings last year, each being on the basis of a round table discussion.

At the last meeting each of the members was given individual research assignments to collect photographs, line drawings, and condensed material suitable for a "How To Do It" manual on Store Lighting. Mr. Caverly and Mr. Cutler were appointed area Committee Chairmen and when their area reports are completed a general meeting of the whole committee will be held to disseminate the entire findings and prepare a first draft of the final report.

Street and Highway Lighting

Charles H. Rex, Chairman

Progress in this Committee's assigned objectives and responsibilities is as follows:

Research — Appraisal, evaluation, and measurement of the seeing and visibility effectiveness of typical roadway lighting systems is being closely followed and aided by the Research Subcommittee. An example is the discomfort glare studies being conducted by Professor Putnam and W. F. Gilmore, Case Institute of Technology, which will evaluate the effects of different luminaire sizes, spacings and mounting heights. Further aid has been extended in interpretation of pavement reflection and brightness data obtained by Professors Kraehenbuehl and Horn at University of Illinois on I.E.S. Research Project 22. These data in form for practical use are essential to progress in roadway lighting.

A member of the Research Subcommittee, Professor D. M. Finch at the University of California, is currently working to develop criteria of visibility appropriate to street traffic at night with techniques of measurement. This is I.E.S. Research Project No. 37.

Standard Practice on Tunnel and Underpass Lighting — The Recommended Practice on Tunnel and Underpass Lighting is being revised and completed in accordance with suggestions by the Committee during its meeting in May. It is expected that this Subcommittee report will be adopted and submitted to Council and then will be submitted to the American Standards Association for consideration as supplement to the American Standard Practice for Street and Highway Lighting.

Parking Area Lighting — Material for parking area lighting is being prepared by a Subcommittee. The proposed requirements for traffic safety, protection against vandalism, and commercial advertising will be worked out with the Store Lighting Committee.

Traffic Sign Lighting — Current practice in the application of lighting for traffic control signs will be illustrated by an exhibit prepared by a Subcommittee with the cooperation of members of the Institute of Traffic Engineers and the American Association of State Highway Officials. Over a hundred responses indicate the desire for information which will aid public and private agencies in handling traffic problems. Subcommittee and Committee work yet to be done involves editing and selection of the most significant illustrations.

Visibility Under Fog Conditions — The effectiveness of properly designed roadway lighting in providing visibility under fog conditions has been the primary purpose of a Subcommittee activity headed by a Committee member who is consultant for several large Turnpike Authorities. The problem may involve other corrective measures such as headlighting, fog dispersal, driver attitudes, etc. The data accumulated by the Subcommittee, along with the experience of its members, have been of some aid in delineating the problem for consideration by the I.E.S. Research Fund Committee. A proposed research program is receiving serious consideration.

Mercury Vapor Lamps — Another Subcommittee has been compiling mercury vapor lamp ratings and performance data which are essential in the application of lighting on streets and highways, in accordance with the I.E.S.-A.S.A. Standard Practice. A report of findings to date is scheduled for completion during the coming year. This will include data on horizontal lamp operation and compensated ballasts.

The investigation has already accomplished much of benefit to those seeking authentic information. These data are being supplemented by investigations conducted by the Committee on Testing Procedures for Illumination Characteristics and A.S.A. Sectional Committees C78 and C82.

Lighting and Traffic Safety — The effectiveness of adequate roadway lighting as an aid to traffic safety is being

reaffirmed by a Subcommittee working in cooperation with the Institute of Traffic Engineers' Committee on Street and Highway Lighting. Thus far eleven cities have reported. Additional complete or partial data will be available during the coming year. The California Highway Dept. has requested replies to a questionnaire directed to all cities and counties. This asks whether their lighting conformed to I.E.S.-A.S.A. Practice for Street and Highway Lighting as well as effectiveness in reducing accidents. The questionnaire is being followed up with quarterly tracers.

It was preceded by a paper, "Why Do We Light Our Streets," presented before the California Governor's Highway Safety Conference by a member of our Committee who is also Chairman of the Technical Subcommittee, Highway Lighting, Pacific Coast Electrical Association.

Significant work has also been accomplished by Subcommittees on Fluorescent Lighting, Photographic Studies, Coordination, Low-mounting-height Lighting, Liaison with International City Managers' Association, and Interchange with Foreign Groups.

At Committee request, the following new Subcommittees have been appointed subject to approval by Council:

Subcommittee on Luminaire Maintenance.
Subcommitte on Photoelectric Control of Roadway Lighting.

Television Production

R. L. Zahour, Chairman

The Committee's Report, "Progress in Television Studio Lighting" which was prepared in 1953 as a supplement to the original 1951 Report "Current Lighting Practice for Television Production," was approved by Council in April.

In the pursuit of the 1954 project, "Lighting for Color Television Production," the Committee held two general meetings during which time three appointed Subcommittees undertook the task of investigating Practices, Equipment, and Light Sources currently employed. Through a planned questionnaire survey, much authentic data was obtained, and each Subcommittee Chairman prepared a preliminary report covering his assignment. These reports have been assembled into a draft of a final Committee report, and copies have been submitted to the Subcommittee Chairmen for review and comment. When these reports are returned, a final report will be prepared and copies will be circulated to all Committee members for letter ballot approval.

Testing Procedures for Illumination Characteristics

Kurt Franck, Chairman

Progress of the Committee's work on its principal assignments was as follows:

(1) "I.E.S. Guide for Electrical Measurements of Fluorescent Lamps—1954." Revised guide published in May 1954 issue of ILLUMINATING ENGINEERING.

(2) "I.E.S. General Guide on Photometry." Guide as revised following committee meeting of January 1954 has been approved by Council and will be brought out as a separate publication.

(3) "I.E.S. Practical Guide on Photometry." Outline of guide prepared by Subcommittee Chairman, O. P. Meaker. Individual topics of the guide assigned to Committee members for detailed preparation of guide material.

(4) "I.E.S. Guide on Photoelectric (Portable) Photometers." Revision of 1937 report in progress under Subcommittee Chairmanship of G. A. Horton. Scope of original report will be expanded to include brightness meters, exposure meters, and color temperature meters.

(5) "I.E.S. Guide for the Photometric Testing of Fluorescent Street Lighting Luminaires." Second draft in preparation by Subcommittee under Chairmanship of J. S. Franklin.

(6) "I.E.S. Guide for Photometry of Searchlights." Subcommittee under Chairmanship of A. W. Krawcek will coordinate second draft of this guide with work done by I.E.S. Searchlight Committee.

(7) "I.E.S. Guide for Electrical and Photometric Measurements of Discharge Lamps Other Than Fluorescent." Draft of guide in progress under Subcommittee Chairmanship of J. S. Franklin.

(8) "I.E.S. Guide on Brightness Measurements." Subcommittee under Chairmanship of J. H. McCulloch in process of preparing first draft. Guide is to include reference and brief description of every type of brightness meter.

(9) Unified Test Report Form "Lighting Engineering Data Sheet." Revision of 1949 form in progress under Subcommittee Chairmanship of E. H. Witte in cooperation with Illumination Performance Recommendations Committee.

I.E.S. Regional Conferences—1955

Southern	Fort Harrison Hotel Clearwater, Florida	March 31-April 1
Southwestern	Gunter Hotel San Antonio, Texas	April 3-5
Inter-Mountain	Westward Ho Hotel Phoenix, Arizona	April 11-13
South Pacific Coast	Statler Hotel Los Angeles, California	April 14-15
Pacific Northwest	Harrison Hot Springs Hotel Harrison Lake, British Columbia	April 25-27
Midwestern	Edgewater Beach Hotel Chicago, Illinois	May 2-3
Canadian	Mount Royal Hotel Montreal, Quebec	May 12-13
East Central	Abraham Lincoln Hotel Reading, Pennsylvania	May 19-20
Northeastern	Fort William Henry Hotel Lake George, New York	June 10-11

TELECAST

LIGHTING NEWS OF CURRENT INTEREST

New I.E.S. Administration Holds First Council Meeting

A summary of action taken at the first meeting of this year's I.E.S. Council indicates a successful start on the 1954-1955 program. The meeting was held October 14 at the Lexington Hotel in New York City. Duncan M. Jones, I.E.S. national President, presided. Present were: Past-Presidents of the Society, Messrs. A. H. Manwaring and E. M. Strong; Vice-Presidents R. F. Hartenstein and M. N. Waterman; General Secretary K. M. Reid; Directors C. C. Shotwell, W. A. Stannard, L. C. Twichell, J. F. Whitehead, Jr. and F. C. Winkler; Regional Vice-Presidents C. J. Berry, J. R. Chambers, M. B. Hastings, S. H. Hazleton proxy for G. E. Park and A. C. Sangster; Executive Secretary A. D. Hinckley, Technical Director C. L. Crouch, Editor Ruby Redford, Advertising and Promotion Manager C. E. Ellis; W. W. Booth, P. H. Hildebrand, D. J. O'Neill and R. G. Slauer.

Membership Elections

Action on a report of the General Board of Examiners, Clifford Miller, Chairman, resulted in the election of 122 Associate Members, 17 Members, and 5 Students. Total membership figures were reported as follows:

September 30, 1954		October 14, 1954
7902	Total Membership	8020
34	Members Emeritus	34*
78	Fellows	78
1939	Members	1954
5621	Associate Members	5723
230	Student Members	231

*Includes 12 Fellows.

A new Sustaining Member was also elected on Council action, as follows:

W. Freeman & Son Ltd.
275 Woodland Drive
Vancouver, B. C., Canada
Official Representative: A. Freeman

T. W. Lauer, reporting for the Membership Committee outlined details of new national contest for Section/Chapter membership drives. The contest is between Sections and Chapters of about the same size in four groups, but this year will be in two parts — one part based on gains of new members, and one based on the least loss of present membership. First place in each group competes for $25.00 prize, with an additional first place prize of $25.00 in each group for the Section or Chapter with the lowest percent loss of membership. Both prizes can be won by one Section or Chapter if, in its group it has both the largest percent gain as well as the lowest percent loss.

Committee Appointments

Action was taken on the appointment of the 1954-1955 committee personnel of I.E.S. A list of the committees and their personnel is published in this issue of Illuminating Engineering on page 27A.

Finance

The required annual report on the Society's financial position for the fiscal year just closed was presented by the retiring Treasurer, Kirk M. Reid. Details of this report are included in the General Secretary's Report published on page 595 of this issue. Warren Booth, Chairman of the Finance Committee presented this year's budget in detail for all phases of expenditure and income for Council's approval.

Regional Activities

Marshall Waterman, I.E.S. Vice-President and Chairman of this committee reported to Council on local activities, referring also to two recent meetings of the committee. On several matters brought up for Council approval, action was taken as follows:

(1) Tar Heel Section to be the new official name of the Carolina Section.

(2) By-laws submitted by four newly chartered Chapters were approved for Palmetto Chapter, Arkansas Chapter, Miami Valley Chapter and Virginia Chapter.

(3) Section Status was approved for Arizona and Utah Chapters, all constitutional requirements having been met.

(4) Section and Chapter boundary changes were approved for New York Section and Arkansas Chapter.

(5) Approval of re-appointment of all local representatives, as recommended by the Regional Vice-Presidents.

Technical Committees

R. F. Hartenstein, Vice-President, reported on the accomplishments of the Technical Committees and Subcommittees, noting that some 50 of these involving some 500 Society members had brought to completion four technical reports, with some five about ready for presentation to Council. Mr. Hartenstein also reported that the Technical Committee Forum was scheduled for November 16-17 at Dearborn Inn, Michigan to provide an opportunity for all technical committee chairmen to become acquainted with the latest thinking of each committee, to work out problems together, and to lay plans for a productive year.

Following this presentation, C. L. Crouch, Technical Director, reported on current activities of the technical committees.

Research Fund Trustees

Research Fund trustees were approved by Council as follows:

Board of Trustees—Brian O'Brien, Willard E. Hengee.
Research Executive Committee—E. M. Strong, Glenn A. Fry, Ralph M. Evans.

Certified Lighting Program Described in New Booklet

"In the Average American City More Than 85% of Industrial and Commercial Lighting is Substandard" is the all-inclusive title of a leaflet just issued by the National Lighting Bureau, in which is described the Certified Lighting Program. Certified Lighting is the industrial and commercial relighting promotion program now being launched nationally by that bureau.

The need for the program is based on a survey conducted in Indianapolis in 1949. During that survey it was found that 85 per cent of the industrial and commercial buildings were not lighted to nationally established footcandle standards. A third of the lighting installations were below World War I stand-

Here and There with I.E.S. Members

Head-table VIP's (right) at the joint meeting of the Georgia Section, I.E.S., and the Atlanta Residence Lighting Forum, October 18, were: l. to r., Paul P. Harrison, Chairman of the Georgia Section; Wesley F. Johnson, Secretary and Treasurer; E. W. Commery, General Electric Co., guest speaker from Cleveland; Mary E. Bush, Chairman of the Residence Lighting Forum; Judd Lough, Vice-Chairman of the Section and the Forum; and L. J. Campbell. About 100 members and guests attended the joint meeting which was held at the Red Fez Club, in Atlanta.

Roy A. Palmer Night was celebrated in the Tar-Heel Section when 60 I.E.S. members from both Carolinas gathered in Charlotte to see Mr. Palmer (right) presented with his Fellow certificate and emblem, by Ralph Robinson (left). Regional V-P Glenn Park (center) witnesses the presentation which was made at the Section's October 11 meeting.

Jack Parks, Chairman of the Michigan Section last year, when it won the Society's Membership Campaign, is presented with the plaque for this honor, by Floyd Sell (right), present Section Chairman. Seated behind podium is Dr. Roger Van Bolt, guest speaker from the Henry Ford Museum and Greenfield Village.

L. C. Twichell, retiring Vice-President of the Great Lakes Region, was presented with a plaque of appreciation by the Society's Past-President S. G. Hibben, at the first Fall meeting of the Rochester Section October 27. Left to right at the speaker's table are: Fred Holcombe; L. C. Twichell; S. G. Hibben, guest speaker; Roy Conheady ,Chairman, Rochester Section; Floyd Owen, the Section's Past-Chairman; and Homer Locke.

Outgoing Vice-President of the Pacific Northwest Region, W. J. Lind (center), accepts a certificate of appreciation for his services to the Region from British Columbia Section Chairman T. H. Doherty (right) at the October 21 meeting of the Section, at the Devonshire Hotel. Also honored that evening was R. W. Racine (left) for his service as Chairman of the British Columbia Section during the past year.

ards, and a sixth were less than five foot-candles, according to their survey.

The Certified Lighting program has been in preparation for nearly three years and is currently in pilot operation in Providence, R. I. Three-day regional conferences were recently held in Boston and Chicago to give lighting salesmen a preview of the training course.

The program, which will be carried on through local lighting bureaus established in communities throughout the United States, will consist of four major portions:

(1) Certification of plans for industrial and commercial installations which meet established industry standards.

(2) Sales training of contractors, jobbers' salesmen and utility salesmen responsible for selling industrial and commercial installations.

(3) Training in the designing and layout of installations to meet certification standards.

(4) Promotion of Certified Lighting to arouse consumer interest and demand.

Conversations are now being held in various communities with electrical industry leaders who are interested in the establishment of local lighting bureaus. The booklet, ". . . 85% of Industrial and Commercial Lighting is Substandard," describes in detail the need for, and the operation of the Certified Lighting Program. Copies are available to those who wish to consider the inauguration in their communities of this industrial and commercial lighting promotion program. Requests should be addressed to the National Lighting Bureau, 155 East 44th St., New York 17, N. Y.

Two I.E.S. Groups Hold Fall Conferences

The Iowa Section and the Cornhusker Chapter of I.E.S. who schedule three multi-speaker conferences during the year in lieu of monthly evening meetings, both held their Fall Conferences on October 22.

The all afternoon meeting of the Iowa Section was held in Davenport, Iowa, and was called to order by Lee Widigen, Conference Chairman. The members were welcomed by Charles H. Whitmore, President of Iowa Illinois Gas and Electric Co. The program which followed was:

Church Lighting—David H. Mason and Carl A. Basedow, Factory Representatives, Chicago.
Office Lighting—Charles Caamplin, Edwin F. Guth Co., St. Louis.
The Trend Toward Luminous Ceilings—David D. Bluford, Luminous Ceilings, Inc., Chicago.
Light's Diamond Jubilee—John Ronayne, General Electric Co., Cleveland.

The program was followed by a Hospitality Hour and a dinner, at which Joe

LIGHTING CALENDAR

Society Events

February 10, 1955—Meeting of I.E.S. Council, New York, N. Y.

March 31 - April 1, 1955 — Southern Regional Conference, Ft. Harrison Hotel, Clearwater, Fla.

April 3-5, 1955 — Southwestern Regional Conference, Gunter Hotel, San Antonio, Texas.

April 11-13, 1955 — Inter Mountain Regional Conference, Westward Ho Hotel, Phoenix, Arizona.

April 14-15, 1955 — South Pacific Coast Regional Conference, Statler Hotel, Los Angeles, Calif.

April 25-26, 1955 — Pacific Northwest Regional Conference, Harrison Hot Springs Hotel, Harrison Lake, B. C.

May 2-3, 1955 — Midwestern Regional Conference, Edgewater Beach Hotel, Chicago, Ill.

May 12-13, 1955 — Canadian Regional Conference, Hotel Mount Royal, Montreal, Que.

May 19-20, 1955 — East Central Regional Conference, Abraham Lincoln Hotel, Reading, Pa.

June 10-11, 1955 — Northeastern Regional Conference, Ft. William Henry Hotel, Lake George, N. Y.

September 12-16, 1955 — Illuminating Engineering Society, National Technical Conference, Hotel Statler, Cleveland, Ohio.

Industry Events

January 7-11, 1955 — National Retail Industry Show, Madison Square Garden, New York, N. Y.

January 31 - February 4, 1955 — American Institute of Electrical Engineers, Winter General Meeting, Hotel Statler, New York, N. Y.

March 13-18, 1955 — National Electrical Manufacturers Association, Edgewater Beach Hotel, Chicago, Ill.

April 17-22, 1955 — Society of Motion Picture and Television Engineers, 77th Semi-annual Convention, The Drake Hotel, Chicago, Ill.

May 10-12, 1955 — Chicago Electrical Industry Show, Conrad Hilton Hotel, Chicago, Ill.

May 11-13, 1955 — Pacific Coast Electrical Association, Inc., Annual Convention, Palace Hotel, San Francisco, Calif.

May 12-13, 1955 — Public Utilities Advertising Association, Annual National Convention, Sheraton Hotel, Chicago, Ill.

June 27 - July 1, 1955 — American Institute of Electrical Engineers, Summer General Meeting, New Ocean House, Swampscott, Mass.

August 15-19, 1955 — American Institute of Electrical Engineers, Pacific General Meeting, Butte, Montana.

October 3-7, 1955 — Society of Motion Picture and Television Engineers, 78th Semi-annual Convention, Lake Placid Club, Essex County, N. Y.

October 3-7, 1955 — American Institute of Electrical Engineers (Fall General Meeting), Morrison Hotel, Chicago, Ill.

October 5-7, 1955 — Canadian Electrical Manufacturers Association (11th Annual Meeting), Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada.

October 17-21, 1955—National Safety Council, 43rd National Safety Congress & Exposition, Chicago, Ill.

October 24-26, 1955—37th Annual Meeting and Sixth National Conference on Standards, American Standards Association, Washington, D. C.

J. F. Whitehead, Jr.

F. C. Winkler

As They Are

Well-known I.E.S. Directors J. F. Whitehead, Jr., and F. C. Winkler inadvertently were mis-identified on page 5A of the October issue of I.E. A last-minute correction before going to press resulted in this slip-up, and to set the record straight they are correctly identified above.

GROUP of educators, school building and equipment manufacturers meet on the organization of the International Institute of School Planning to be located at Indiana University. Left to right, seated: President H. B. Wells, Indiana University; Milton Clamage, National Chemical and Manufacturing Co.; J. McW. Stone, DuKane Corp.; R. L. Shoemaker, DuKane Corp.; A. E. Meyer, Attorney; F. I. Wilson, Wakefield Brass Co.; D. B. Harmon, School Building Consultant; E. D. James, Architect; and Prof. P. W. Seagers, Indiana University. Standing: C. A. Wilkelhake, Design Consultant; J. R. Nicholson, Pittsburgh-Corning Co.; Hugh Bernie, American Seating Co.; J. W. Martin, School Consultant; Wayne Jervis, Weber Costello Co.; J. M. Ziv, Public Relations Consultant; K. H. Cunningham, Owens-Illinois Glass Co.; Z. A. Marsh, Minneapolis-Honeywell Regulator Co.; and E. E. Higgins, Indiana University.

Kimmel, President, Republic Electric Co., was speaker.

The Cornhusker Chapter's Annual Fall Conference took place in Lincoln, Nebraska, with schoolboard members, directors, superintendents and architects especially invited.

The program included:

Light's Diamond Jubilee—Ford Bates, Omaha Public Power District.
Light Sources—Past and Present — Warren Grimes, General Electric Co.
Light and Color Conditioning — T. S. Halpin, E. I. DuPont de Nemours (a film and discussion on relation of light and color.
Trends in School Lighting—Willard Allphin, Sylvania Electric Products Co.

The Cornhusker Conference was also followed by a social hour and evening banquet.

Conference on Standards — Three-Day Meeting in New York

The Fifth National Conference on Standards was sponsored by the American Standards Association, November 15-17, at the Hotel Roosevelt in New York City. The Conference was held in conjunction with the 36th Annual Meeting of A.S.A., which constituted the first session.

A Safety Standards Session was sponsored by the American Society of Safety Engineers, with Edward R. Granniss, of Royal Liverpool Insurance Group, presiding. A parallel session, the afternoon of November 15, was on International Standards and What They Mean to the American Electrical Industry. This was a report on the accomplishments of the Golden Jubilee of the International Electrotechnical Commission in Philadelphia, with R. C. Sogge, President of the U. S. National Committee of I.E.C. presiding.

Company Standardization was treated in a full-day meeting November 16, under the sponsorship of the Committee on Standardization of the National Association of Purchasing Agents and the A.S.A. Company Member Conference. Parallel sessions were a morning meeting on Standards and Quality Control, sponsored by the Metropolitan Section of the American Society for Quality Control; and the afternoon Symposium on Standards for Agriculture.

Two morning sessions were held November 17, one on Color Television and the other on What's Ahead for Standardization — Through the Eyes of the Technical and Business Press.

The Annual Award Luncheon, November 11, featured the presentation of the Standards Medal to Dr. John Gaillard, Mechanical Engineer recently retired from the staff of A.S.A., and Lecturer on Standards at Columbia University. Another award made at the luncheon was that of the Howard Coonley Medal to Thomas D. Jolly, Vice-President of the Aluminum Co. of America and a Director of A.S.A.

Street and Highway Safety Lighting Clinic Held in Chicago

A total of 132 attended the Street and Highway Safety Lighting Clinic in Chicago, October 27 — State, County, City and Village officials, representatives from public utilities and equipment manufacturers, electrical contractors, consulting engineers and architects. The clinic was co-sponsored by the Chicago Lighting Institute with the Chicago Section of I.E.S. with the following other organizations:

Chicago Association of Commerce and Industry
Chicago Motor Club
Chicago Real Estate Board
Citizens' Traffic Safety Board
Cook County Traffic Safety Commission
Institute of Traffic Engineers, Midwest Section
Junior Association of Commerce and Industry
National Automobile Theft Bureau
Northwestern University Traffic Institute

Francis D. Wyatt, Electrical Engineer with the Chicago Park District, was Chairman of the morning session which began with an address of welcome by Norman E. Brown, Manager of Sales Promotion for Commonwealth Edison Co. Warren Edman, Manager of Street Lighting Department of Holophane Co., then gave an outlined coverage of "Lighting Fundamentals." The program continued with:

PANEL ON LIGHT SOURCES — Francis D. Wyatt, Discussion Leader.
Incandescent Lamps — Sam H. Eaton, Sylvania Electric Products, Inc., Chicago.
Mercury and Sodium Vapor—Carl F. Jensen, Westinghouse Electric Corp., Chicago.
Fluorescent Lamps—Ben F. Avery, General Electric Co., Chicago.
RECESS
Types of Luminaires — Dana Rowten, Westinghouse Electric Corp., Cleveland.
Control and Operating Equipment — Stacy Standley, Line Materials Co., Milwaukee

Chairman of the afternoon session was Lloyd M. Johnson, Commissioner of Streets and Sanitation for the City of Chicago. The program was:

PANEL ON TYPES OF POLE EQUIPMENT—Alva B. Winters, Revere Electric Mfg. Co., Chicago, Discussion Leader.
Wood—James Fahey, Joslyn Mfg. and Supply Co., Chicago.
Concrete—James Lewis, American Concrete Corp., Chicago.
Steel—L. F. Heckman, Union Metal Mfg. Co., Canton, Ohio.
Aluminum—George L. Moore, Aluminum Corp. of America, Cleveland.
RECESS
Application of Modern Street Lighting — R. M. Swetland, General Electric Co., Lynn, Mass.
Street Lighting—An Aid to Traffic Safety — Chief Michael Ahern, Chief of Traffic, City of Chicago.
Modern Street Lighting Reduces Automobile Losses—National Automobile Theft Bureau.
Street Lighting—An Aid to Crime Prevention — Supervising Captain Albert Anderson, Police Dept., City of Chicago.
What Lies Ahead — Francis Wyatt, Chairman of the Conference.

The clinic was held in the Chicago Lighting Institute at 37 South Wabash Ave., Chicago. Tuition for the morning and afternoon sessions was $7.00.

Debate-Type Meeting Breaks Record in St. Louis

A rather unique program format at the St. Louis Section meeting October 14 drew a record-breaking attendance of 330. This included 127 architects and consulting engineers, 72 contractors, 33 school officials and 98 I.E.S. members.

Subject of the meeting was a debate-type discussion on "Classroom Lighting —Incandescent vs Fluorescent." Participants were George J. Taylor, Eastern Sales Manager of Day-Brite Lighting Inc., and Henry G. Clum, General Sales Manager of Silvray Lighting Inc.

Points made clear by both speakers were that comparable classroom lighting may be had either with incandescent or fluorescent lighting systems. Moreover, there are some points at which it is feasible and desirable to use the two in combination, though there are certain areas where one may be preferable to the other.

Initial costs of installation of both incandescent and fluorescent along with total annual capital costs, operating cost and maintenance were compared through a series of charts.

The two speakers urged that specification of key lighting be used for attainment of maximum comfort and efficiency for most personnel using a given set of facilities.

SEATED at the head table at the October 14 meeting of the St. Louis Section are: left to right, O. S. Wilkins, Program Chairman; Edwin C. Ryan, Board of Managers; Dr. Bernard C. Jander, President of the Missouri State Optometric Society; Robert Elkington, President of the St. Louis Chapter of A.I.A.; Henry G. Clum, guest speaker; Brooks Chassaing, Section Chairman; G. J. Taylor, guest speaker; Carter Lewis; and Robert J. Welch, Secretary-Treasurer of the Section.

Palmetto Chapter Is 68th Of Local I.E.S. Groups

The total of Sections and Chapters in I.E.S. became 68 on October 12, when the Palmetto Chapter received its Charter from Glenn E. Park, Vice-President of the Southern Region. Mr. Park gave an interesting talk entitled "What of the Future," and then presented the photographs of the first prize winner in the Southern Regional contest for "My Most Interesting Lighting Job," Lighting a Railway Terminal.

A special guest of honor at the charter meeting was Roy A. Palmer, newly elected Fellow of I.E.S.

Officers of the Society's youngest Chapter are: Chairman, Roy E. Hallman; Secretary-Treasurer, Glen M. Rice; Board of Managers — J. W. Edwards, Woody Fogle, Arthur R. Moore, Alvin H. Phillips, and Rudolph Tollison.

Reports from those attending this meeting, which was held at the Greenville Hotel in the Chapter's "home city" of Greenville, S. C., indicate an enthusiasm and spirit which forecast increased growth and activity in the Palmetto Chapter.

Annual Plant Maintenance Show Set for Chicago

The sixth annual Plant Maintenance and Engineering Show has been announced for the International Amphitheatre, in Chicago, January 24-27, 1955, according to Clapp and Poliak, Inc., producers of the event.

Expected to be the largest in its history, the show will be the first industrial exposition to occupy the huge new $2,000,000 hall, which has been built as an addition to the Amphitheatre. The new hall has 188,000 square feet of space, with headroom of from 20 to 26 feet. Railroad sidings go directly into the new hall and accommodate 10 freight cars simultaneously.

Study Class in Illumination Sponsored by Pittsburgh Section

A series of eight weekly meetings on Lighting Fundamentals has been sponsored by the Pittsburgh Section of I.E.S. with the Electric League of Western Pennsylvania. The two-hour sessions began October 25 and were held at the Westinghouse Electric Corp. Conference Room in the Union Bank Building, Pittsburgh.

The sessions used films, slides, visual audio aids and other educational devices, and provided opportunity for questions and discussion. The eight study classes were on the following topics:

1—Light is What You Make It; Light and Vision; Illumination Terminology.
2—Quantity Requirements and Quality Requirements of Good Illumination; Importance of Color Illumination.
3—Incandescent, Electric Discharge and Fluorescent Lamps.
4—Principles of Light Control; Systems of Light Control; Calculation of Interior Illumination.
5—Office and School Lighting.
6—Store Lighting.
7—Store Lighting.
8—Industrial Lighting and Floodlighting.

Industrial Research Activities Subject of New Survey

Questionnaires have been sent recently, to about 12,000 industrial concerns requesting information on their research and development activities, as part of a National Science Foundation survey of industrial science. This announcement was made by Alan T. Waterman, Director of the Foundation. The survey is being conducted by the United States Department of Labor, Bureau of Labor Statistics.

Plans for the survey were developed in consultation with the research committee of the National Association of Manufacturers, the Industrial Research Institute, and other industry groups.

(Continued on page 12A)

Core and coil construction is carefully designed for minimum power loss; close control of noise and heating. Quality insulation throughout—protects against failure, assures longer life.

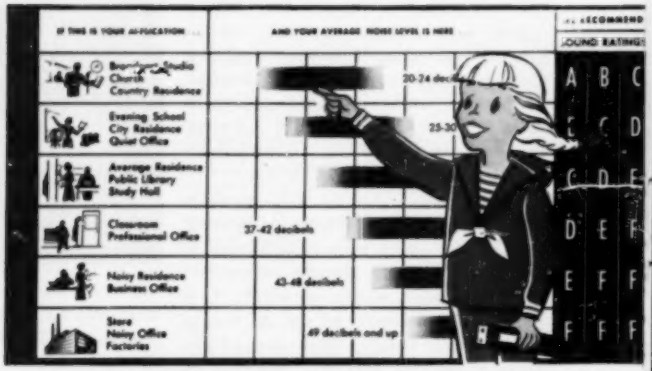
All components, like this G-E Pyranol† capacitor, are manufactured to our precise specifications.

†Reg. trade mark of General Electric Co.

Every part of a G-E ballast is carefully designed, manufactured, tested and assembled to give you the best ballast value.

Flora shows you*

General Electric



1. SOUND RATING—Only G-E ballasts are sound-rated to assure you of meeting your sound level requirements. You can choose the proper G-E ballast whether it's for a quiet installation or for an application where noise is less important. G-E sound rating eliminates expensive noise complaints.

4. LAMP-MATCHED DESIGN—The ballast governs light output and life of the fluorescent lamp. G-E ballasts are lamp-matched to provide up to 50% longer lamp life and up to 30% more light output. Here you save two ways—lower lamp replacement costs and more light from your installation.

Whether you use, install, specify or make fluorescent fixtures, G-E ballasts mean savings to you!

The six reasons why you save, described by Flora above, grow out of these simple facts:

- **G-E ballasts are designed to high engineering standards (1, 3, 4, 5 above).**
- **G-E ballasts are made under exacting quality control standards (2 above).**
- **G-E ballasts are backed by complete sales and engineering services (6 above).**

Only G.E. offers you all these money saving features.

In every conceivable way, we make sure you get more when you use G-E ballasts. For example, G-E engineering standards

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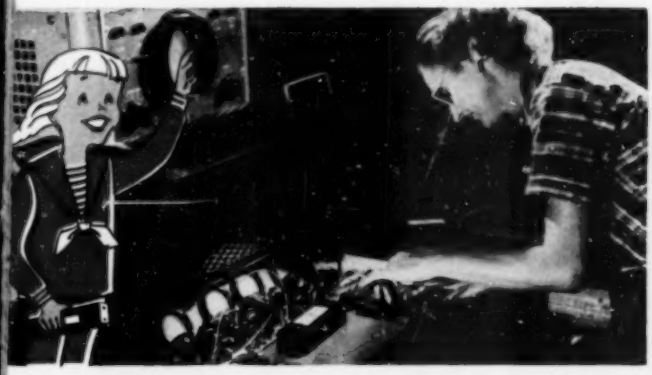
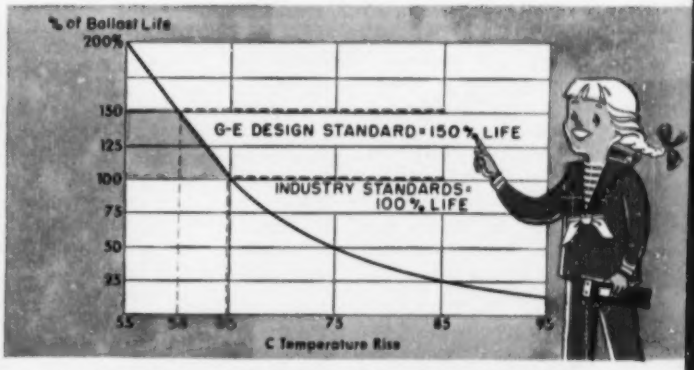
six ways . . .

ballasts help you save lighting dollars



2. UNIFORMLY HIGH QUALITY—Lighting specifiers have learned to depend upon the consistently high quality of G-E ballasts. Rigid material specifications and constant production line tests mean uniformly good ballasts; save lighting dollars on early replacement and maintenance costs.



3. LONGER LIFE—G-E ballasts are designed to operate 10% cooler than U.L. and Certified Ballast Manufacturers' standards. Tests show that a 10% reduction in ballast temperature rise can mean up to 50% longer ballast life, giving you half again as much ballast life!

5. PROVED PRODUCT LEADERSHIP—General Electric has the largest group of specially trained ballast design and development engineers in the industry. They're constantly improving G-E ballasts, assuring you of all benefits of top quality when you "specify" General Electric.

6. COMPLETE CUSTOMER SERVICES—General Electric's extensive sales, warehousing, and engineering organization is anxious to serve you. These unequalled facilities can provide services for you which no other ballast manufacturer offers. These extra services mean real saving to you.

actually exceed the specifications established by the Certified Ballast Manufacturers where extra quality pays off to you. Another example: Ten quality control stations make dozens of physical and electrical checks during manufacture to assure that each ballast measures up to the high G-E standards.

Next time, specify General Electric Ballasts. Dollar for dollar they're your best ballast value.

LOOK FOR THIS G-E BALLAST TAG ➔

A G-E ballast tag on your fixture is proof that it's equipped with a top-quality ballast. It's the easy way to be certain. For further information on G-E ballasts, contact your nearest G-E Apparatus Sales Office or G-E Distributor. General Electric Company, Schenectady 5, New York. 431-7

***Miss Flora Ballast, G-E Ballast Mascot.**

Progress Is Our Most Important Product

GENERAL ELECTRIC

(*Continued from page 9A*)

"The findings," stated Dr. Waterman, "should be valuable to companies in planning and appraising their own research programs, besides contributing greatly to the formulation of national policies for the strengthening of scientific research."

Thirty major industrial groups are represented by the 12,000 samples, and among the companies canvassed 4000 employ 1000 or more employees. The survey will give estimates on a nation-wide basis of the amounts spent for the conduct of research by size of companies and by industry groups; of the source of these funds by major economic sectors; and of the amount spent by companies to finance research conducted elsewhere, for example, in universities and research institutes.

A second phase of the survey will consist of intensive interviews with representatives of about 200 selected large corporations. It is expected that these interviews will provide clues to specific bottlenecks faced by industry in planning its research. It is hoped that some estimates may also be obtained of the economic pay-off of research.

Finally, a historical analysis of selected companies will be carried out in an attempt to reconstruct the gross pattern of industrial research over the past two or three decades. From such information it may be possible to estimate future scientific manpower and capital requirements for research and development activities in the United States.

of the Dayton Power and Light Co., who has been a member of the Society since 1913 and who was a co-worker with Thomas A. Edison.

There were 76 members and guests attending the meeting at the Dayton Engineers Club.

Profits Through Visioneering — Theme of Georgia Workshops

The 1954 Occupational Vision Workshops at Georgia Tech, December 2 and 3, had a session on lighting describing how proper lighting pays dividends in higher production, quality and greater safety. Sponsored by the Southern Occupational Vision Council in conjunction with the Engineering Extension Division of Georgia Institute of Technology, the congress had an overall theme of "Profits Through Visioneering."

The session on lighting featured Willard Allphin, Sylvania Electric Products Inc., who teamed up with industrial plant executive Blanton W. Mills, Standards Engineer with Flint River Cotton Mills, Albany, Ga., to relate the concrete results of the installation of a good lighting program in his plant three years ago.

The Council president is Lambdin Kay of the Associated Industries of Georgia. Representing the illuminating engineers on the council workshop committee is I.E.S. member Harry Yopp, of the Georgia Power Co.

Improved Design Headlamps Introduced for 1955 Autos

A new type of Sealed Beam headlamp was unveiled recently by the Automobile Manufacturers Association. The improved design is the product of a four-year co-operative engineering effort by U. S. motor vehicle and headlamp manufacturers, working closely with public officials in the states and in the provinces of Canada. A similar program produced the present Sealed Beam design introduced in 1939. The new lamp is completely interchangeable with Sealed Beam lamps presently in use, and will be adopted as standard equipment by all motor vehicle manufacturers in the U. S. and Canada during the 1955 model year, the A.M.A. said.

Development of the improved lamp grew from the fact that night driving conditions have changed significantly during the past 15 years, the A.M.A. said. The program was initiated by the Engineering Advisory Committee of the A.M.A. in September of 1950, at the request of the Engineering Committee of the American Association of Motor Vehicle Administrators. The A.A.M.V.A. is composed of officials responsible for the administration of motor vehicle regulations in all of the states and territories of the United States and the provinces of Canada. Responsibility for the program was then assigned to the A.M.A.'s Vehicle Lighting Committee,

(*Continued on page 15A*)

Miami Valley Chapter Now Formally Chartered

The official Charter and Gavel were formally presented to the Miami Valley Chapter of I.E.S. on their Charter Night dinner meeting September 28, two officers of the new Chapter receiving them for the membership.

Chairman E. J. Rommel was given the gavel by incoming Regional Vice-President A .C. Sangster. This was the gift of the "next-youngest" Virginia Chapter and was made of wood from the estate of Thomas Jefferson at Monticello.

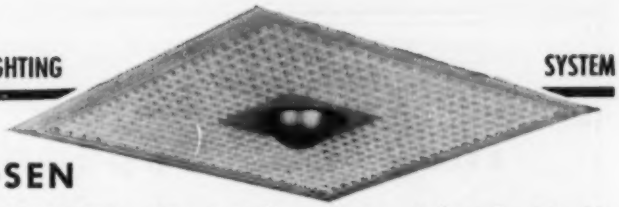
Les Twichell, retiring Vice-President of the Great Lakes Region presented the charter to Chapter Vice-Chairman Robert J. Schulte. R. F. Hartenstein, Senior Vice-President of the I.E.S., spoke about the working of the Society, describing the organization as a whole and its composition of Regions, Sections and Chapters.

Main speaker of the evening was Mr. Frank M. Tait, chairman of the board

PRESENTATION of the official gavel was one highlight of the Charter Meeting of the Miami Valley Chapter of I.E.S., held September 28. The gavel was presented by A. C. Sangster, incoming Vice-President of the Great Lakes Region to the Chapter Chairman, E. J. Rommel. Left to right are: Mr. Sangster, Mr. Rommel, R. F. Hartenstein, Senior Vice-President of the Society; and R. M. Tait, main speaker of the evening.

Skylike

THE INCANDESCENT LIGHTING SYSTEM



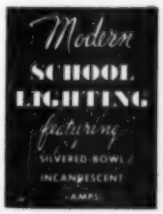
ARCHITECT-CHOSEN

throughout the entire SECOTOQUE SCHOOL, West Islip, Long Island, N. Y.

MR. JAMES VAN ALST, architect of the Secotoque School says...

"The present trend toward lower ceiling heights in school construction makes it necessary to use recessed lighting equipment rather than the conventional pendant luminaires. Not all recessed equipment is satisfactory under these conditions because of high brightness, excessive contrast with adjacent ceiling areas and limited distribution. The Skylike system, because of its indirect nature, offers more even distribution and lower brightness than many other types of recessed equipment and was therefore selected for all classrooms, the auditorium and cafeteria. The fixture is of pleasing modern design and its initial cost is low. More important, however, is the fact that Skylike units require a minimum of cleaning maintenance and may be relamped from the floor by use of a pole-type lamp changer."

The SKYLIKE Lighting System is being selected by leading schools throughout the nation. Architects favor it for its adaptability to modern design and for its effective method of solving all the problems inherent in school lighting. Contractors favor it for its easy installation with a minimum of labor. School officials like its comparative low initial cost and simple, inexpensive maintenance. Investigate SKYLIKE for any school lighting problem.



MODERN SCHOOL LIGHTING

A 12 page booklet describing Silvray and Skylike units that solve, in a practical way, all school lighting problems. Free upon request... address Dept. 1254

THERE'S NOTHING LIKE SKYLIKE FOR SCHOOL LIGHTING

SKYLIKE LIGHTING, INC. A SILVRAY ASSOCIATED COMPANY
BOUND BROOK, NEW JERSEY

They* Can Depend on
ETL CERTIFICATION
of Lighting Equipment

* **Architects,** Illuminating Engineers and Consulting Engineers know that when they specify "ETL Certified" they are taking the quickest, most positive means of protecting their clients without curtailing their choice in either style or price.

* **Contractors,** Industrial Buyers and Governmental Users know when they see the label "Certified by ETL" that the equipment is safe, efficient and designed for good performance.

* **Distributors** and Dealers who sell "ETL Certified" lighting equipment find it promotes customer confidence and satisfaction, because it represents tested value. They also find it moves faster because it's so often specified and demanded.

ETL for more than a half-century has been serving manufacturers and users of light-sources, lighting fixtures, auxiliary equipment, portable lamps and other electrical products. Their competent, impartial, and continuous testing program assures all concerned that the "ETL Certified" equipment meets the rigid standards adopted by the manufacturer for the protection of the user.

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(Continued from page 12A)

composed of engineering representatives from the various vehicle manufacturers. Actual engineering development work was delegated to a special subcommittee of engineers from five producers of motor vehicle headlamps.

Before the new lamps may be installed on new motor vehicles as original equipment, however, restrictive statutes in some states must be changed, the A.M.A. reported. These statutes, which govern the type of lighting equipment that may be installed on motor vehicles, are applicable to the present Sealed Beam specifications. The new lamps, therefore, would be in technical violation of some of these statutes. To legalize use of the new lamps, 22 jurisdictions must pass corrective legislation in 1955. Vehicle manufacturers, the A.M.A. said, are hoping to be able to start factory installation of the lamps by mid-year.

CHARTER of the Arkansas Chapter of I.E.S. was accepted by John Williams (left), Chairman of the new Chapter, while Southern Regional Vice-President Glenn Park looks on. At right, making the presentation is Fred Niell, Chairman of the parent Mid-South Chapter last year, the time the Arkansas group grew to Chapter status.

C.L.I. Jubilee Program Reaches Audience of 20,000

The dramatic story of light's history was given to a total of nearly 20,000 by the Chicago Lighting Institute this year, commemorating Light's Diamond Jubilee. Jubilee lectures were given by 72 top speakers comprising a special speakers' bureau for the Jubilee. Some 247 talks were included in this special program from June 1954 through October. The program was under the direction of Carl W. Zersen, Director of the Institute.

UL Appoints Conference For Portable Lamp Industry

Underwriters Laboratories has appointed a new Industry Advisory Conference to represent the portable lamp industry, it was announced recently by Morris Thau, president of The Lamp and Shade Institute of America.

Formation of the new group marks the first time the portable lamp industry has been classified as a separate entity by Underwriters Laboratories. Previously they were grouped together with installed lighting fixtures.

The three-man conference for portable lamps will include two Institute representatives: Richard F. Schneller of the Verplex Co., Essex, Conn., and S. A. Seligman of Colonial Premier Co., Chicago. The third member, termed an independent manufacturer, has not been announced.

Arkansas Chapter Starts Year With Charter Meeting

Charter Night for the new Arkansas Chapter was October 29, with Southern Regional Vice-President Glenn Park as principal speaker, taking as his subject, "Looking to the Future."

Other featured guests were the Chairman and immediate Past Chairman of the parent Mid-South Chapter. Fred Niell, who was Chairman of the parent Chapter last year when the new group grew to Chapterhood, presented the Charter to John S. Williams, Chairman of the Arkansas Chapter. Mid-South Chairman James Fletcher, acting as proxy for the Palmetto Chapter, presented their gift of the gavel to Arkansas Vice-Chairman Stanford Rowe.

New York City's Christmas Tree

A picture isn't available yet, because at press time the tree isn't up yet. But visitors to New York City from December 15 on are going to wonder what details are involved in the lighting of the enormous tree in Rockefeller Plaza and the Christmas lighting decorations of the promenade. Here they are:

TREE — The tree is a 65-foot Norway Spruce, weighing approximately 4 tons and is estimated to be 65 years old. It will come in by truck and trailer from the estate of Elmer Rowe, Belvidere, N. J.

Two thousand 7-watt "firefly" lamp bulbs requiring two miles of wiring throughout the branches will light the tree. It will be decorated with 1,800 plastic globes in three sizes, 12", 8" and 6", and in three colors, green, red and yellow. The globes will be illuminated with 40-, 25- and 15-watt lamps, respectively. The tree will be topped with a 4-foot white plastic star.

WREATHS—Two 16-foot wreaths of pine, balsam and hemlock, sprinkled with pine cones, will be hung on either side of the 30 Rockefeller Plaza entrance of the RCA Building.

CHANNEL AREA — The Channel display this year will consist of twelve 9-foot angels sculptured entirely in wire, holding aloft 5-foot trumpets, raised toward the giant tree in Rockefeller Plaza.

Fashioned around a sturdy steel framework to withstand the rigors of mid-Manhattan winds, each angel has been sculptured of aluminum wire, bent, twined and fastened to form a heroic figure. The 7-foot folded wings of hand-meshed aluminum wire create a solid effect which is in marked contrast to the abstract appearance of the angel itself. Wire of .061" thickness was used for the wings; various thicknesses up to $\frac{3}{8}$" were employed for other parts of the figure. About 75 pounds of aluminum wire were required for each angel.

Copper wire was utilized for decoration in the design of the skirts and in the creation of the angels' hair. Halos

(Continued on page 16A)

(Continued from page 15A)

and trumpets of brass tubing complete the figures. More than 18 miles of wire were used in the Channel display.

A striking night-time effect will be achieved through the use of 150 miniature 2-watt electric lamps scattered through the flowing robes of each angel. In addition, the whole display will be floodlighted from above.

FOUNTAIN BEDS — The six fountain beds in the Channel Gardens will be filled with evergreen boughs and highlighted with red, yellow and green 8" and 6" plastic globes entwined in aluminum wire.

The over all decorative scheme for the Rockefeller Center Christmas display was designed by Robert Carson of the firm of Carson & Lundin, resident architects for Rockefeller Center, Inc., and executed by the Rockefeller Center Operating Department.

Industrial Lighting Conference and Clinic Sponsored by Consolidated Edison

Facts of good industrial lighting and what it can do for them were outlined to some 300 industrial plant managers of the New York area last month. Sponsored by Consolidated Edison Co., New York City, an industrial Lighting Conference and Clinic was held at the company's auditorium in New York, in three all-day sessions November 3, 4 and 12.

The primary purpose of this promotional conference was to acquaint these people with the principles of I.E.S. recommended practice, outlining also the benefits to industry of good lighting. The presentation included fundamentals of general lighting, techniques of applying I.E.S. recommendations for industrial lighting, development of lighting fixtures and light sources, and maintenance including the group replacement plan.

Following the presentation, a clinic was conducted at a number of booths, each of which was devoted to a specific phase of industrial lighting practice such as fixtures, lamps, local lighting, inspection lighting, maintenance, speed of vision, adequate wiring and lighting layout. Useful and pertinent literature was distributed.

The same top speakers in their fields were featured at each of the three meetings. The total attendance was approximately 300 including the largest manufacturers in the New York area. All those attending were guests of the company at a buffet luncheon served each of the three days.

Details of the program included the following:

Lighting as a Production Tool — Clifford Miller, Lighting Division, Consolidated Edison Co.

Modern Industrial Lighting Equipment
Lamps — Sam Hazleton, General Electric Co.
Fixtures — Walter Garret, Westinghouse Electric Corp.

Good Industrial Lighting — Examples — John Gunther, Consolidated Edison Co.

Modern Maintenance Methods — George Taylor, Day-Brite Lighting Inc.

Introduction of Clinic — J. S. Voorhees, Consolidated Edison Co.

FEATURED speakers at the Industrial Lighting Conference and Clinic sponsored by Con Edison are: left to right, George Taylor, Walter Garret, Cliff Miller, Sam Hazleton, and John Gunther.

Three-Day Lighting Show Feature of Milwaukee Jubilee Program

Six sessions on different aspects of lighting plus an exhibit showing the latest in lighting equipment were presented in Milwaukee as a commemoration of Light's Diamond Jubilee, October 20-22. Sponsored by the Milwaukee Section, I.E.S.; Electrical League of Milwaukee, and the Wisconsin Electric Power Co., the lectures and exhibits took place in the Public Service Building Auditorium. The program was as follows:

October 20 — Afternoon — School Lighting

Lighting Practices for Schools — Willard Allphin, Sylvania Electric Products, Inc.

Wisconsin Progress in School Lighting — A. L. Buechner, Dept. of Public Instruction, Madison, Wis.

A Pictorial Story of Milwaukee's Schools — J. H. Wanska, School Consultant, Wisconsin Electric Power Co.

October 20 — Evening — Office Lighting

Modern Office Lighting Practice — R. L. Oetting, General Electric Co., Cleveland.

Examples of Milwaukee's Office Lighting — C. N. Laupp, Supt. of Special Services, Wisconsin Electric Power Co.

October 21 — Afternoon — Store Lighting

Today's Store Lighting Practice — C. M. Cutler, General Electric Co., Cleveland.

A Look at Milwaukee's Stores — E. H. Schaefer, Lighting Engineer, Wisconsin Electric Power Co.

October 21 — Evening — Industrial Lighting

Lighting for Today's Industrial Plants — W. H. Kahler, Westinghouse Electric Corp., Cleveland.

October 22 — Afternoon — Residential Lighting

Residential Lighting Practice — Edith Buchholtz, Westinghouse Electric Corp., Bloomfield, N. J.

Garden Lighting — J. L. Franaway, Wisconsin Electric Power Co.

October 22 — Evening — Street and Highway Lighting

Standard Practice of Street Lighting and Benefits of Good Street Lighting — W. H. Edman, Manager of Street Lighting, Holophane Co., Inc.

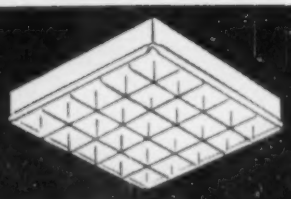
Should It Have Been "Light's Centennial"?

The following quotation is from the Postscript page, by the anonymous Lumeritas, in the October issue of *Light and Lighting*, the magazine of the Illuminating Engineering Society (London).

"I am indebted to Dr. J. W. T. Walsh for the following short account of an interesting lighting event. 'The town of Springe, not far from Hanover, has lately been celebrating the hundredth anniversary of the invention by Heinrich Goebel of a practical electric lamp. Goebel was born in Springe in 1818. He emigrated to America in 1848 and lived in New York, where he carried out experiments on the use of an electrically heated carbon filament as a source of light. It is related that in 1854 he not only

(Continued on page 18A)

Only - Luve·tile



When it comes to Low brightness, large area light sources . . .

because . . .

LUVE-TILE in the long run is the most economical illuminated ceiling you can buy.

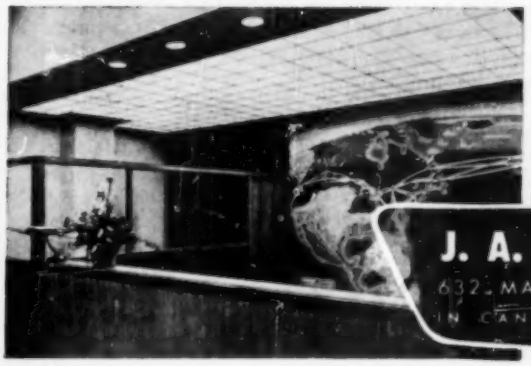
LUVE-TILE is easy to maintain—dirt collection is much less rapid than with other types . . . and it will not hold insects and other small matter.

LUVE-TILE is hinged, servicing of fixtures is easy. Rigid to handle, and light in weight, it is simple to remove and wash.

LUVE-TILE may be assembled to suit any room and custom-made work is never necessary. No unsightly horizontal bars or rosettes are used for support.

LUVE-TILE comes in 4 shades making possible unlimited colour combinations. Sprinklers and air ducts are concealed and wiring and other work may be simply surface mounted. Also low cost acoustic material may be sprayed on the cavity above the tile for sound proofing.

LUVE-TILE is practical and economical to use in any area, right down to a few square feet. It is also widely used in display for special effects.



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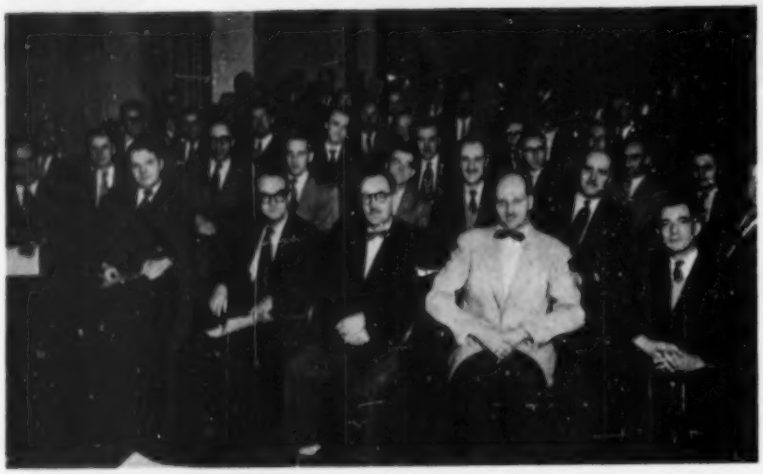


JOINT meeting with La Corporation des Maitres Electriciens of Quebec was the first meeting of the year for the Quebec Chapter of I.E.S., on October 18 at the Quebec Power Building. Attendance was 43 persons to hear Frank Reed, architect and professional engineer, John C. Virden, Ltd., who came from Toronto to address the group.

(*Continued from page* 16A)

illuminated his shop window with lamps of his own making, but he also drove along the streets of New York a carriage illuminated in the same way, the supply for the lamps being derived from primary cells. The celebration lasted a week and centered round a commemorative obelisk erected to mark the centenary and surmounted by a 16-ft-diameter outline of a lamp in luminous tubing; choirs chanted a Hymn to Light, and Prof. Helwig gave an address. Later there was a pageant with scenes from Goebel's life.' I must confess I was previously ignorant of Goebel as an electric lamp pioneer. The names Swan and Edison are better known in this connection and a Jubilee of Lighting is going on in the United States to mark the seventy-fifth anniversary of Edison's invention of a carbon filament electric lamp."

Residential Wiring Handbook Available in New Edition

Publication of a new edition of the Residential Wiring Handbook has been announced by the Industry Committee on Interior Wiring Design. Superseding the 1946 edition, the new Handbook raises the standard for wiring adequacy to a minimum of 100 amperes for service entrance capacity in all residential housing of 3,000 square feet of floor area or less.

The revisions of the new booklet represent the first change since 1946 in adequacy standards, which are advocated nationally by the National Adequate Wiring Bureau and by 75 local bureaus which certify the wiring in new housing, and its appearance closely follows a decision of the National Association of Home Builders to adopt on a voluntary basis the 100-ampere service entrance.

Changes in the design of today's new homes and in the living habits of their buyers are reflected in the new standards. Wiring design standards and recommendations are premised on the one-story, open floor plan house with multi-purpose rooms, but are applicable also to two-story or multiple-family dwellings and in the rewiring of older homes.

The Illuminating Engineering Society is one of the three endorsing organizations, the others being the American Institute of Electrical Engineers and the American Society of Agricultural Engineers. Chairman of the Industry Committee on Interior Wiring Design is H. R. Stevenson, the Detroit Edison Co.; Secretary is A. C. Bredahl, Westinghouse Electric Corp., who, with G. E. Shoemaker, Philadelphia Electric Co., represents the I.E.S. on the Committee.

Copies of the Handbook may be purchased at 25 cents per copy from the Adequate Wiring Bureau, 155 East 44th St., New York; or the Edison Electric Institute, 420 Lexington Ave., New York, another of the sponsoring organizations. Quantity prices may be obtained upon application to these two agencies.

Joint Meeting in Washington Gives Preview of 1955

What's happening in lamp development, fixture development and methods and applications in lighting constituted a "Lighting 1955" program sponsored jointly by the Capital Section of I.E.S. and the Electric Institute of Washington. The all-afternoon-and-evening meeting was held November 16 in the Electric Playhouse in the Pepco Building in Washington, D. C.

The afternoon sessions were on "Light Sources" with William S. Fisher, General Electric Co., Cleveland, as speaker; and on "Lighting Fixtures," George Clark of Sylvania Electric Products Inc., in Wheeling, West Va., the lecturer. After dinner, Robert L. Zahour, Westinghouse Electric Corp., Bloomfield, N. J., spoke on "Lighting Application."

Electrical Contractors' Exposition Emphasizes Lighting Trends

New trends and products in the lighting and wiring fields were stressed by the Gross Electric Co.'s Wholesale Division at an October 15 exposition for electrical contractors from Ohio and Michigan.

Nearly 600 persons attended the exposition which included films, displays and demonstrations, staged by the 25 national manufacturers represented by Gross. In the six-hour show, films were shown on school lighting and up-to-date wiring methods; displays and demonstrations stressed lighting for offices, stores, homes, industry and churches; new lighting display boards, new built-in appliances, outdoor and specialty lighting, light dimming equipment were demonstrated.

Materials and Methods Studied For Modern School Construction

The Aluminum Company of America and the New York architectural firm of Eggers and Higgins have announced that a joint study of the materials and methods used in the construction of modern schools is two-thirds completed. Approximately 40 schools built since World War II have been visited since the project was started in February of this year. Eventually 60 schools will be studied.

On a tour through 16 states, an architectural team from Eggers and Higgins is studying building costs; and annual costs for maintenance, heating, lighting, ventilating and insurance. Practically every modern material used in the con-

(*Continued on page* 21A)

Photograph by Consolidated Edison

You get Permanence, Quality, Beauty with PLEXIGLAS

This luminous-area lighting at the County Trust Company, Mt. Vernon, N.Y., illustrates the important advantages obtained with PLEXIGLAS acrylic plastic diffusers.

Permanence. Rigid, strong and durable, PLEXIGLAS is noted for freedom from discoloration, and resistance to breakage. It has a firm, solid appearance in harmony with other room surfaces.

Quality Illumination. PLEXIGLAS provides maximum transmission of light and complete, edge-to-edge diffusion that accents the quality of architectural design.

Beauty. Lighted or unlighted, PLEXIGLAS is pleasing to the eye—the most beautiful of all types of plastics.

For the *best* in illumination, specify PLEXIGLAS diffusers for luminous ceiling areas and large-area lighting equipment for indoor or outdoor use. We will be glad to send you detailed information on this multipurpose lighting material.

PLEXIGLAS *is a trade-mark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.*

Canadian distributor: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

FIRST to provide ample strength in all-aluminum arms and arm-shaft joints through patented, seamless elliptical arms requiring no bracing for lengths up to 8 feet. On longer arms, one horizontally elliptical member, integrally welded to the arm, eliminates need for side-sway bracing.

FIRST to develop fabricating equipment and methods to permit use of high strength aluminum alloys.

FIRST to develop and produce seamless, tapered shafts from high-strength, extruded tubing in a wide range of diameters.

Seven firsts . . . . . All are P&K

FIRST to pioneer the Aircomatic method of welding for fast, strong welds and negligible deterioration of alloy strength. All P & K welds are guaranteed . . . all P & K welding personnel and equipment is certified by U. S. Government agencies.

FIRST to stress use of castings of heat-treatable aluminum alloy, and first to introduce permanent mold castings for transformer bases, shoe and pedestal bases . . . with smooth surfaces and strong grain structure.

FIRST to eliminate unnecessary scrolls, tie-rods and other ornamental frills.

FIRST to design and build its own tapering machine to handle all diameters of extruded aluminum tubing.

P & K . . . Producer of America's Most Modern All-Aluminum Standards and Brackets

FOR LIGHTING

TRAFFIC SIGNAL POSTS — TRAFFIC AND COMMERCIAL SIGN POSTS

SEVEN P & K FIRSTS! They add up to this: P & K All-Aluminum Standards, Arms and Posts do the job better, easier and at far less cost than any other "pole" of any other material or design.

WRITE FOR THE NEW P & K CATALOG . . . and use the planning and advisory services without obligation.

Pfaff & Kendall

84 Foundry Street
Newark 5, New Jersey

(Continued from page 18A)

struction of these schools will be analyzed to determine its present condition and effectiveness. A study will be made of the latest research developments of industrial firms engaged in the manufacture of school equipment and building materials.

It is expected that the survey will be completed by spring of 1955, when the results of the studies will be published.

Green Bay Study Club Elects Officers

Ralph Cheney, Chairman of Extension Activities of the Milwaukee Section, I.E.S. has reported that the active Study Club in Green Bay, Wisc., has elected its officers for the current year. These are:

Chairman — Roderick W. Virgo, Beemster Electric Co.

Vice-Chairman — G. E. Shears, Westinghouse Electric Supply Corp.

Secretary — Howard Johnson, Wisconsin Public Service Corp.

Scrapbook Being Compiled By Light's Diamond Jubilee Committee

A report on the recent year-long celebration of Light's Diamond Jubilee is being compiled by the Jubilee Committee, with a basic part constituting a Scrapbook. The book will contain clippings, advertisements, booklets, programs, photographs, radio and TV spots and scripts.

BOOKS AND PAMPHLETS

Christmas Lighting and Decorating for the Home, by Theodore Saros, published 1954 by D. Van Nostrand Co., Inc., New York, N. Y.; 161 5¼ x 8¼ pages, 110 illustrations, $1.95.

There has long been a seasonal need for a book on this topic. This one includes much good basic information on home Christmas lighting. Although at first glance some of the lighting suggestions might seem obvious to an engineer or technician, the book will undoubtedly be of interest to the householder. The author's intent was more to stimulate originality than to provide detailed drawings to be copied. However, there is much "how-to" material with ideas and suggestions in preparing home Christmas decorations both outdoors and indoors. Materials and equipment to use outdoors are outlined; good design and proper outdoor lighting techniques are discussed in the first part of the book. Tips for competing in Christmas lighting display contests are given, and helpful hints on photographing decorations are included.

Indoor decorations, including basic information on materials, equipment, design and lighting procedure are covered next.

Throughout the book each lighting and decorating suggestion is carefully detailed and pictured with numerous photographs. Some of the principles and ideas presented by Mr. Saros will apply also for larger-scale displays.

Lamps — How to Choose and Use Them, 12-page non-technical booklet on how to select lamps for residence applications, is available from Westinghouse Lamp Division Regional Sales Promotion offices. Order designation is A-6434 and the price is $3.00 per hundred.

Sign Design Blueprints, by sign designer George F. Meyers, containing exact dimensions to scale, wiring diagrams and suggested tube colors, are available for such businesses as jewelry stores, used car lots, supermarkets, drug stores, banks, restaurants, shoe stores, taverns and suburban shopping centers. A new book containing 24 such complete blueprints is available to sign and advertising men from Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.

ABOUT PEOPLE

Oliver F. Burnett, Jr., president of Kelso-Burnett Electric Co., Chicago, received the Contractors Medal and Purse, given under the James H. McGraw Award for Electrical Men, at the general meeting of the National Electrical Contractors Association in New Orleans on October 27. Mr. Burnett received the award in recognition of his constructive leadership in the development of creative methods for business promotion in the electrical contracting industry.

The Illuminating Engineering Society (London) has announced the induction of **E. C. Lennox** as President of their Society. Mr. Lennox, who is manager of the Wear Sub-Area of the North-Eastern Electricity Board, presented his Presidential Address, "Lighting and Electricity Supply," at the opening meeting October 12 at the Royal Institution.

Dr. Warren B. Boast has been named Head of the Department of Electrical Enginering at Iowa State University, succeeding **M. S. Coover** who has become associate Dean of Engineering.

Professor E. M. Strong, I.E.S. Past-President and Professor of Electrical Engineering at Cornell University, has been selected by the Eta Kappa Nu Fraternity as a juror in selecting the outstanding young electrical engineer for 1954. The winner will be announced at a dinner January 19, at the Hotel Statler in New York City, in connection with the winter meeting of the American Institute of Electrical Engineers.

The Acheson Medal and Award of the Electrochemical Society was presented to **George W. Heise** at the 106th Convention in Boston October 5, in recognition of his outstanding technical achievements and contributions to the welfare and growth of the Society. Mr. Heise recently retired from the position of Associate Director of the National Carbon Company, Cleveland, and is presently serving as chairman of advisory Battery Panels for both the Office of Naval Research and the National Research Council. The Acheson Award, consisting of a gold medal and a cash prize of $1000, is the highest honor of the Electrochemical Society.

Dr. Bennett S. Ellefson, formerly Director of Research, has been appointed Technical Director of Sylvania Electric Products Inc., and will advise management on its research and engineering programs. Dr. Ellefson joined Sylvania in 1937.

Albert F. Metz, chairman of the board and chief executive officer of The Okanite Company, was elected president of the National Electrical Manufacturers Association, November 10 at a business meeting of the NEMA Board of Governors. Mr. Metz succeeds **J. H. Jewell,** vice-president of Westinghouse Electric Corp. In addition to the president, the Board also elected five vice-presidents and a treasurer: vice-presidents — **W. A. Elliott,** president, Elliott Co.; **F. F. Loock,** president, Allen Bradley Co.; **J. J. Mullen, Jr.,** president, Moloney Electric Co.; **B. C. Neece,** president, Landers, Frary & Clark; **W. V. O'Brien,** vice-president, Apparatus Sales Division, General Electric Co. The new treasurer is **A. A. Berard,** president, Ward Leonard Electric Co.

The appointment of **Charles H. Goddard** as manager of utility sales for Sylvania Electric Products Inc. has been announced. Mr. Goddard, a Past-President of I.E.S., was previously in charge of marketing and product planning for the Lighting Division. In his

(Continued on page 22A)

(Continued from page 21A)

new position Mr. Goddard will make his office at the Lighting Division headquarters in Salem, Mass.

Frank R. Innes, associate editor on *Electrical World,* McGraw-Hill Publishing Co., retired November 1 after 29 years with the magazine. Mr. Innes will be succeeded by **E. Bryson Sessions,** who joined the staff recently after several years with Utah Power & Light Co.

Chalmer J. Carothers, Jr., has been appointed Sales Manager — Special Products for the Lighting Division of Sylvania Electric Products Inc. He will be in charge of the sale of fluorescent sign tubing and wiring devices with offices at the company's Lighting Division headquarters in Salem, Mass.

Robert C. Blatt has joined the staff of the American Society of Refrigerating Engineers as publications director, working out of the association's headquarters at 234 Fifth Ave., New York, N. Y. Mr. Blatt has been associate editor of *Electrical World* since 1949 and was formerly chief airport lighting engineer for the Civil Aeronautics Administration. Mr. Blatt has been an active member of I.E.S., serving on many of its technical committees.

W. D. Ligon has been named manager of the Westinghouse Electric Corp.'s lighting division plant in Vicksburg, Miss., succeeding **D. E. Jenkins,** who has been transferred to the staff of the division manager in Cleveland. Mr. Ligon has most recently been project manager at the company's Sunnyvale, Calif. plant.

Pittsburgh Reflector Co., through its president, **H. C. Zinsmeister,** announces the merging of that company with Holden Lighting Manufacturers Ltd. of Toronto, Ont. The move has been made, it is said, to strengthen the position of both companies in their particular marketing areas. **P. H. Green** is President of the Holden Lighting Manufacturers.

Benjamin Electric Manufacturing Co., Des Plaines, Ill., has expanded its operations on the West Coast by the formation of three new districts and the appointment of a Division Manager. **Oliver C. Westberg,** formerly sales representative in St. Louis, has been named the company's Pacific Coast Division Manager, succeeding **Carl O. Martin** who is retiring after 41 years, under the company's retirement program. Division headquarters remain at 829 Folsom St., San Francisco. The new districts established and their managers are: Southern District, **G. A. Hochenauer,** with headquarters at 923 East Third St., Los Angeles; Central District, **John Keyes,** with headquarters at 829 Folsom St., San Francisco; Northern District, **Henry Huber,** with headquarters at 3018 45th Ave., S. W., Seattle.

The National Association of Electrical Distributors has announced the appointment of **Arthur W. Hooper** as Executive Director, succeeding the late **Charles Gordon Pyle.** Mr. Hooper was formerly editor of *Electrical Wholesaling* magazine.

Howard G. Haas has been named vice-president in charge of advertising and sales promotion for The Mitchell Manufacturing Co., Chicago, a newly created post. Mr. Haas has been with Mitchell since 1950 as director of advertising and sales promotion.

The election of **Howard G. Jacobsohn** as president and board member of Electro Engineering Products Co., Inc. has been announced by the board of directors. At the same time, **David E. Bright,** former president, was named Chairman of the Board.

Gerald M. Marks has been appointed Chicago area District Manager for the Electro Silv-A-King Corp. of Chicago and Reading, Pa. Mr. Marks' former connection was with Electric Supply Corp. as Manager of their Lighting Department.

Amplex Corp., independent lamp manufacturer, has named **Robert M. Freeman** as General Sales Manager. Prior to joining Amplex last year, Mr. Freeman operated an electrical wholesaling business on Long Island, N. Y. In his new capacity, he will coordinate company-distributor sales policy under the direct supervision of **W. R. Freeman,** Vice-President in charge of Sales.

George W. Douglas has been appointed manager of lighting sales in the Corning Glass Works specialty products department, succeeding **Arthur S. Tylor,** manager of the department for the past ten years. Mr. Tylor is taking over the San Francisco lighting sales office. Mr. Douglas joined the company's lighting sales staff in 1945, and served as representative in New York City and in Philadelphia.

Robert L. Kleinfeld has been named regional sales manager of the Photolamp Department of Sylvania Electric Products, Inc., and will be responsible for the eastern sales area of the United States. Mr. Kleinfeld replaces **Henry W. Jones,** who was recently promoted to photolamp merchandising manager.

Marshall Lewis and **Nathan Tamm** have been appointed to executive positions with Light & Power Utilities Corp., Memphis, Tenn. Mr. Lewis is new Sales Manager, and Mr. Tamm Plant Supervisor, both handling the company's line of fluorescent lighting fixtures.

Frank Van Gilluwe, District Manager for the Holophane Co. in Los Angeles, has retired, being succeeded by **Joseph Platt,** formerly Sales Engineer in the Los Angeles office.

Deaths

Sections and Chapters of the I.E.S. report with sorrow the passing of the following members:

Howard E. Conrad (Maryland Section), Industrial Engineer with Tristate Electrical Supply Co., Baltimore, Md.

William E. Hawley (Pittsburgh Section), Partner in Hawley and Wainwright, Pittsburgh, Pa.

C. H. More (Florida Chapter), recently retired from the American Can Co.

Hugh H. Richardson (Tennessee Valley Section), District Manager for Line Material Co. in Nashville, Tenn.

Samuel P. Russell (Northern California Section), H. B. Squires Co., San Francisco, Calif.

NEW MEMBERS

At the meeting of the I.E.S. Council Executive Committee, held in Detroit, Michigan, November 15, 1954, the following were elected to membership. Names marked * are transfers from Associate Member grade.

ALAMO CHAPTER

Associate Member:
Cunningham, L. C., Celanese Corp. of America, Bishop, Texas.

ARIZONA SECTION

Associate Member:
Sullivan, E. J., Vinson Carter Electric Co., Phoenix, Ariz.

ARK-LA-TEX CHAPTER

Associate Member:
Hargrove, Q. W., Neild-Somdal Associates, Shreveport, La.

BRITISH COLUMBIA SECTION

Associate Members:
MacKenzie, J. L., Canadian General Electric Co. Ltd., Vancouver, B. C.
Zieroth, G. R., Canadian General Electric Co., Ltd., Vancouver, B. C.

CAPITAL SECTION

Member:
Killian, T. J., Catholic University, Washington, D. C.

CENTRAL ILLINOIS CHAPTER

Member:
*Brown, J. W., Central Illinois Light Co., Peoria, Ill.

(Continued on page 38A)

Beautiful, Practical Lighting

the new **LUME-GLOW**

by **MITCHELL**

IDEAL LUMINOUS SEMI-INDIRECT COMMERCIAL LUMINAIRES

New MITCHELL "Lume-Glow" sets the standard of excellence in comfortable indirect lighting. It is specifically designed for low brightness contrast and features pleasing eye-ease illumination. Designed for pendant mounting, Lume-Glow luminaires achieve a desirably high upward component coupled with diffused downward lighting to achieve this new concept in glare-free, restful illumination. The superb combination of abundant light output with low surface brightness is achieved through the original use of polystyrene plastic formed in an ultra-shallow streamlined contour of unusual beauty and distinction. Finally, "Lume-Glow" offers exceptional advantages in simplified installation and maintenance. For full details, specifications and performance data, write for Bulletin No. 4.

★

The "Evenglo" plastic diffusing shield provides the most desirable low surface brightness

★

High upward component, combined with plastic diffusing shield, provides the eye-ease illumination of indirect lighting

★

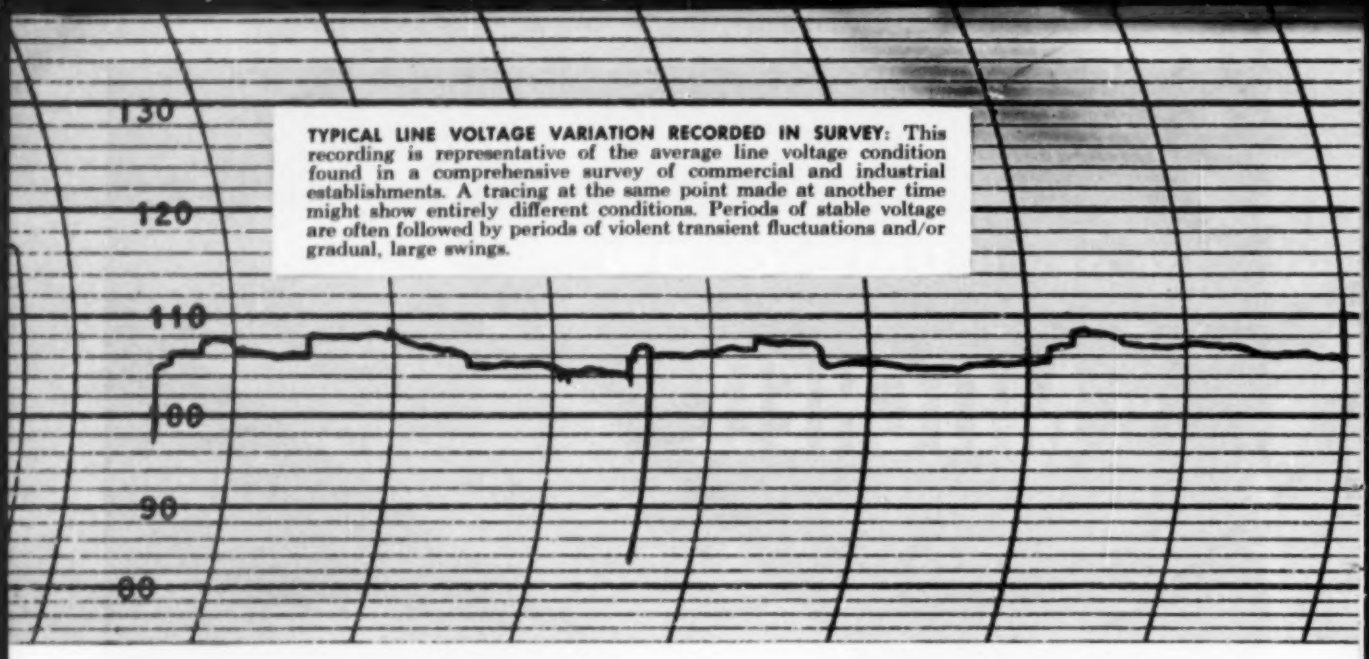
Ultra-shallow contour achieves a smart, streamlined effect to create clean, tailored-looking installations in the most distinguished interiors

★

Available in 4-Foot, 2-Lamp or 4-Lamp Luminaires (choice of Rapid Start, Slimline or Medium Bi-Pin), and in 8-Foot, 2-Lamp or 4-Lamp Slimline. Matching Spots, Fill-Ins and Corner Boxes are available

where quality counts, specify **MITCHELL**

MITCHELL MANUFACTURING CO.
2525 N. Clybourn Ave., Chicago 14, Illinois
In Canada: Mitchell Mfg. Co., Ltd., 19 Waterman, Toronto



TYPICAL LINE VOLTAGE VARIATION RECORDED IN SURVEY: This recording is representative of the average line voltage condition found in a comprehensive survey of commercial and industrial establishments. A tracing at the same point made at another time might show entirely different conditions. Periods of stable voltage are often followed by periods of violent transient fluctuations and/or gradual, large swings.

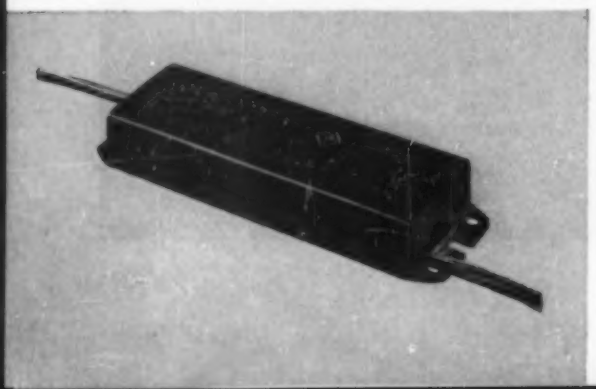
Stabilize performance of fluorescent lighting systems—regardless of line voltage variations—with Sola Constant Wattage Ballasts

Greater line voltage variations at point-of-use may exist than is generally appreciated. This condition arises from the constant and ever-growing demand for electric power, increasing size of loads to be served at one location, and increasing inadequacy of users' wiring installations.

This substantial variation of voltage is usually beyond the control of the commercial power utilities. Their voltage is carefully controlled at the point of distribution; and it is the starting and stopping of heavy loads near the point of use, which usually causes the trouble.

These line voltage variations have definite adverse effects on fluorescent lighting performance when systems are ballasted with conventional, non-regulating transformers. But Sola *Constant Wattage* Ballasts provide stabilized conditions regardless of typical line voltage fluctuations. Three major areas of lighting system performance under fluctuating line voltage conditions are compared in the following three points:

1. *The level of illumination specified at a particular working surface will drop when line voltage drops.* Sola Constant Wattage Ballasts maintain lumen output constant in face of line voltage drops. You get all the light your system was designed for.
2. *Lamp life is shortened by line voltage surges.* Sola

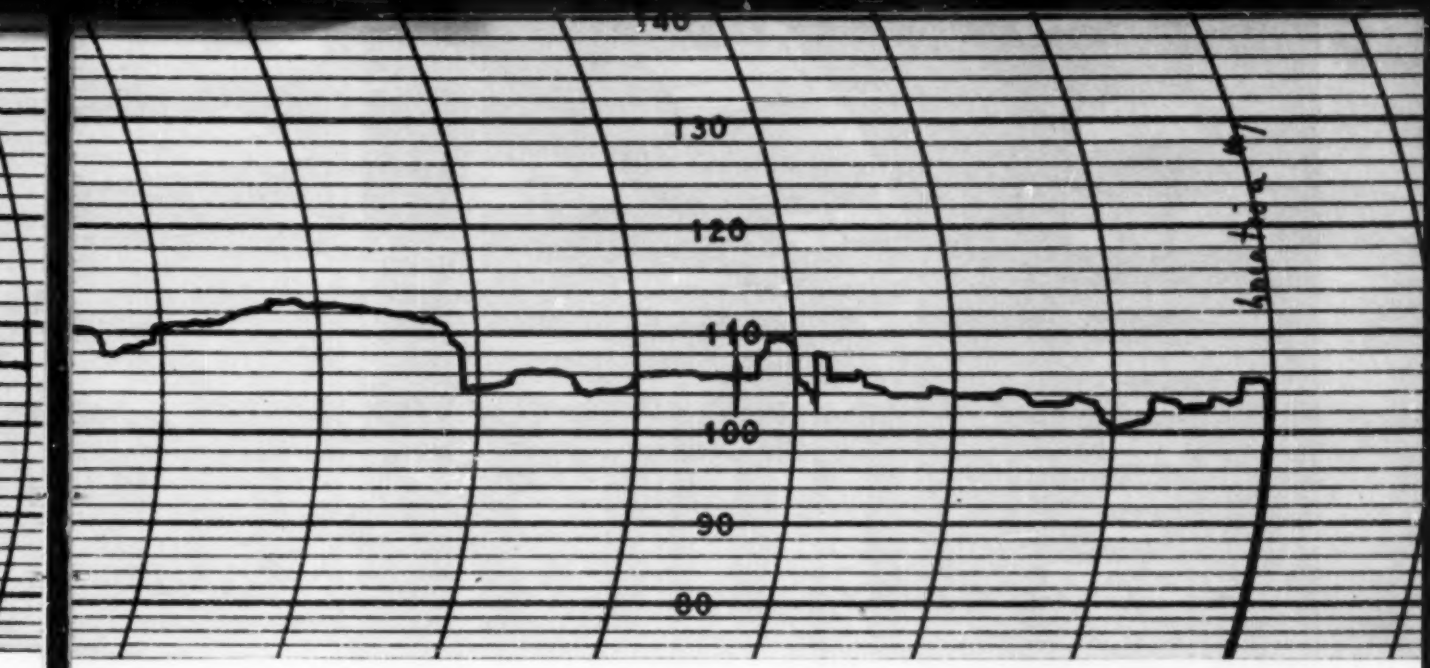


HOT CATHODE BALLASTS

RAPID-START LAMP BALLASTS: For 2-T12, 40w rapid-start lamps. Series-sequence operation, peak/rms ratio approx. 1.5 at 118v. Lumen output held constant to within ±2% or less, in face of line voltage variations as great as 10%. 300v from electrode to ground for reliable starting. Case height only 1-13/16". Low temperature rise, quiet in operation.

COLD CATHODE BALLASTS

HIGH or LOW PRESSURE COLD CATHODE LAMP BALLASTS: For 93 inch, 25mm. diameter cold cathode lamps. High power factor, close to unity at all times, even though one lamp is inoperative on a two-lamp parallel ballast. Pressed-in core and coil construction. Lumen output varies less than ±2.5% with primary voltage variations as much as ±15%. Light weight, compact.



Constant Wattage Ballasts automatically control lamp current within a safe value. You get lamp life over and above what you pay for.

3. *Overall operating efficiency is lowered by line voltage fluctuations.* Sola Constant Wattage Ballasts continuously deliver regulated energy to lamp electrodes which results in: positive starting, cool operation, and self-protection against damaging ballast heat rise when lamps fail. Stabilized operation of fluorescent lighting systems reduces maintenance time and cost—results in dependable operation. You get all the service you pay for.

The major types of Sola Constant Wattage Ballasts are shown across the bottom of these pages. For more information, please write or phone for a Sola sales engineer. He will give you further help in adapting Sola Constant Wattage Ballasts to any new or revamped lighting installation you are considering.

SOLA *Constant Wattage* **BALLASTS**

SOLA ELECTRIC CO.

4633 W. 16th St., Chicago 50

Branch offices and representatives in principal cities

Write for any of the following bulletins, giving complete electrical and mechanical specifications.

RAPID START BALLASTS,
Bulletin 3L—FL-199

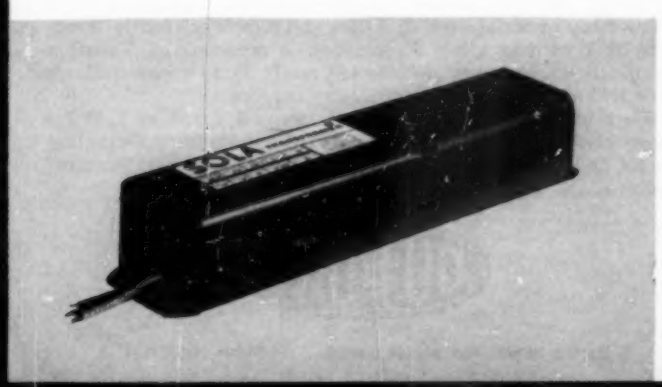
COLD CATHODE BALLASTS,
Bulletin 3L—PFL-152

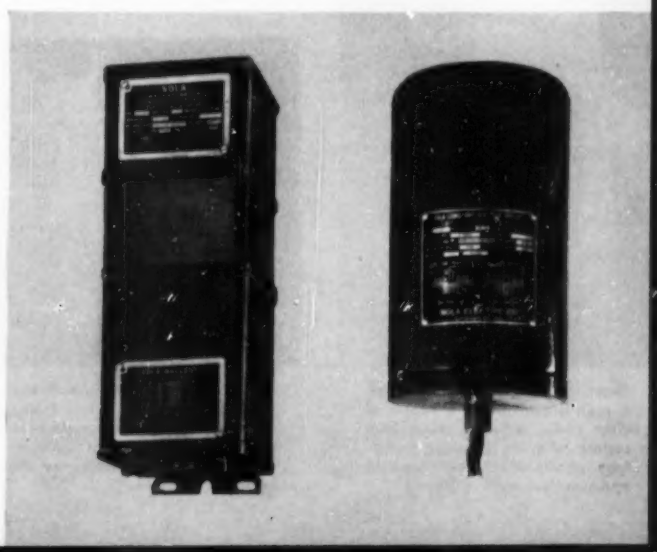
OUTDOOR MERCURY VAPOR BALLASTS,
Bulletin 3L—MV-208

INDOOR MERCURY VAPOR BALLASTS,
Bulletin 3L—MV-211

MERCURY VAPOR LAMP TRANSFORMERS

OUTDOOR AND INDOOR MERCURY VAPOR LAMP BALLASTS: Outdoor weather-proof unit (right) for commercial and industrial applications. Indoor design shown at left. Both maintain lumen output within ±2% against line voltage variations as great as 25%. Primary taps eliminated, low starting current surge, no extinguishing on line voltage dips, open and short circuit protection.

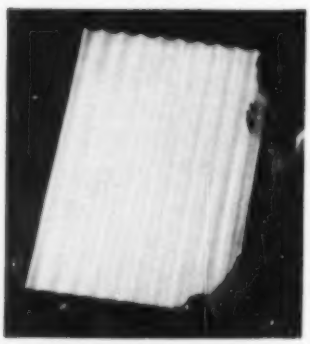




Sheeting of extruded "Lucite" acrylic resin is available in a variety of clear and translucent colors from custom extruders. Extruded troffer-type panels of "Lucite" transmit optimum light without glare.

Lighting as a design element

Specify extruded Du Pont LUCITE® acrylic resin for well-engineered lighting effects



Extruded panels of "Lucite" like this are used for light-diffusing ceilings. "Lucite" has excellent impact strength and color stability. Its light transmission does not deteriorate with time.

Luminous panels and sheeting of "Lucite" can be fabricated in an unlimited number of designs of unusual beauty. Panels of "Lucite" can be extruded in widths up to 4 feet—and in a variety of diffusing, clear and translucent colors. Extruded sheets of "Lucite"—flat, formed or corrugated—make unique light-diffusing ceilings.

"Lucite" is highly resistant to shattering and weathering. This engineering material used in lenses and panels efficiently transmits light without glare. Fabrication is economical to custom specifications. Fixtures of "Lucite" retain their initial uniform color and appearance with minimum cleaning.

Write to the E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 2812 Du Pont Building, Wilmington 98, Delaware, for complete information on extruded "Lucite" now available for engineered lighting.

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

COMMITTEES

COMMITTEES 1954-1955

All committees are appointed by the President, subject to approval of the Council and, except as provided in the Constitution, terminate at the time of the first Council Meeing each administration, in the month of October. The scope of each committee is indicated.

Duncan M. Jones, President, ex-officio member of all committees.

STANDING COMMITTEES

BOARD OF FELLOWS — To evaluate the eligibility of candidates for transfer to grade of Fellow according to procedures approved by the Council.

H. L. Logan, Chairman, Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y

R. M. Evans	S. G. Hibben
W. V. C. Foulke	J. M. Ketch
	R. M. Love

COUNCIL EXECUTIVE — To conduct the affairs of the Society between Council meetings.

Duncan M. Jones, Chairman, Curtis Lighting of Canada, Ltd., 991 St. Antoine St., Montreal, Que., Canada.

R. F. Hartenstein	G. J. Taylor
K. M. Reid	M. N. Waterman

FINANCE — To have direct supervision of the financial affairs of the Society and to present to the Council an annual report on its financial condition. To make recommendations to the Council as to the investment of moneys and upon all specific appropriations. To prepare and submit for approval of Council not later than the October meeting a budget of income and expense for the ensuing fiscal year.

W. W. Booth, Chairman, General Electric Co., 1260 Boston Ave., Bridgeport, Conn.

[illegible], Caverly	C. C. Keller
P. H. Hildebrand	G. J. Taylor, ex-officio

GENERAL BOARD OF EXAMINERS — To investigate the qualifications of all applicants for admission to membership; to elect or reject applicants for the grade of Associate Member and Student Member, to report such action to the Council; and to make recommendation to the Council regarding applications for transfer or election to the grade of Member and for transfer to the grade of Member Emeritus.

Clifford Miller, Chairman, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York 3, N. Y.

Svend Brunn	H. E. D'Andrade

MEDAL AWARD — To evaluate the eligibility of candidates for award of the I.E.S. Medal according to procedures approved by the Council.

George Crampton, Chairman, Lenox Instrument Co., 2010 Chancellor, Philadelphia, Pa.

Berlon Cooper	S. G. Hibben
G. F. Dean	B. J. Jensen
C. H. Goddard	A. H. Manwaring
Ward Harrison	E. M. Strong
	Walter Sturrock

PAPERS — To procure, review and approve all technical papers and discussions thereof, for presentation before National Conferences of the Society.

R. M. Zabel, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

H. F. Davidson, Vice-Chairman, Hydro-Electric Power Comm. of Ontario, 620 University Ave., Toronto, Ont.

L. E. Barbrow	W. P. Lowell, Jr.
L. J. Buttolph	J. A. Schneller
C. D. Fawcett	G. A. Trosper
B. F. Greene	H. L. Wright

PUBLICATIONS — To be responsible for the procurement, review and approval of all material for the publications of the Society other than technical papers approved by the Papers Committee for presentation at National Conferences of the Society and their discussions and committee reports, for which it will have publication responsibility only. Shall also be responsible for the editing, printing and business management of the publications of the Society; specific exceptions may be made by Council.

J. S. Schuchert, Chairman, Duquesne Light Co., 435 Sixth Ave., Pittsburgh, Pa.

G. T. Anderson	John Ronayne
H. G. Clum	J. A. Schneller
Aileen M. Page	R. M. Zabel

Section and Chapter Representatives

P. K. Allen	S. B. LeCornu
H. C. Burrall	Andrew Louaragand
C. O. Christensen	W. G. McIntosh
Roy Coss	John Metzenthin
H. F. Cummings	C. J. Miller, Jr.
John Dougherty	H. F. Miller
J. M. Doyle	M. E. Monck
J. W. Dumbell	C. R. Nelson
A. W. Felt	Paul Norris
J. M. Gaskin	P. L. Osteen
J. Gilbreath	H. J. C. Pearson
Harold Gruber	N. O. Reed
M. R. Hazzard	W. D. Richards
R. J. Huff	Alex Springs
James Johnson	D. C. Thomas
W. A. Lampinen	R. G. Turpin
	C. C. White

Subcommittee on Changes and Improvements

John Ronayne, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

Subcommittee on Editorial Content

R. M. Zabel, Co-Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

J. A. Schneller, Co-Chairman, Lighting Products Corp., Highland Park, Ill.

L. E. Barbrow	B. F. Greene
L. J. Buttolph	W. P. Lowell, Jr.
H. F. Davidson	G. A. Trosper
C. D. Fawcett	H. L. Wright

Subcommittee on Publication Sales

H. G. Clum, Chairman, Silvray Lighting Inc., 100 W. Main St., Bound Brook, N. J.

Section and Chapter Representatives

E. A. Adams	R. J. Huff
J. Bennett	J. J. Hughes
N. W. Bethune	J. E. Livingston
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J. D. Harris	R. M. Winton
W. S. Hemker	R. S. Wissoker
G. E. Hersam	R. E. Wozniak

Subcommittee on Technical Data Sheets

George T. Anderson, Chairman, Philadelphia Electric Co., 1015 Chestnut St., Philadelphia, Pa.

C. L. Crouch	Eve Freyer
M. N. Flynn	Ruby Redford

Section and Chapter Representatives

T. W. Beadle	Buford Martin
W. J. Beran	C. J. Miller, Jr.
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A. Lange	H. M. White
Judd Lough	Alan Whitehead
R. D. Madden	J. F. Wueste
W. N. Mangold	H. R. Young
	A. G. Zitelli

Home Lighting Data Sheets

Aileen M. Page, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

GENERAL COMMITTEES

ADVANCE PLANNING — To study the operation, program, publication activities, membership classifications and financial structure with a view of its immediate and long-range objectives and to make recommendations to Council.

E. M. Strong, Chairman, Cornell University, Ithaca, N. Y.

A. H. Clarke	W. P. Lowell
L. S. Cooke	C. C. Keller
B. J. Jensen	J. F. Whitehead, Jr.
	Robert Wiseman

ADVISORY BOARD ON COMMITTEE PERSONNEL — To examine the organization, accomplishments, and assignments of committees and prepare not later than July 1st of each year a proposed list of committees and personnel.

R. F. Hartenstein, Chairman, Ohio Edison Co., Akron, Ohio.

G. W. Beals	A. H. Manwaring
C. L. Crouch	E. M. Strong
A. D. Hinckley	M. N. Waterman

BOARD OF NOMINATION — To prepare a nomination ticket containing the names of those who are deemed best suited to serve as officers and directors in positions to be filled at the ensuing election

S. G. Hibben, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

A. H. Manwaring	E. M. Strong
and Regional Representatives	

CONSTITUTION AND BY-LAWS — To prepare for Council proposed amendments to the Constitution.

G. F. Dean, Chairman, Toronto Hydro-Electric System, 14 Carlton St., Toronto, Ont.

J. B. Browder	R. G. Slauer
G. K. Hardacre	Walter Sturrock
	John S. Walsh
and Regional Representatives	

(Continued on page 28A)

COORDINATING COMMITTEE FOR DEFENSE— To contact various Government Agencies concerned with National Security suggesting cooperation and participation in specific projects as an aid to solution of their problems. Recommending the placement of lighting study projects in present committees or the appointment of study project committees to the Society President and to expedite such study projects and guide accepted reports into proper Government channels.

A. F. Wakefield, Co-Chairman, The F. W. Wakefield Brass Co., Vermilion, Ohio.

G. D. Mills, Co-Chairman, 283 Osborne Ave., Britannia Heights, Ottawa, Ont.

J. W. Bateman	C. L. Crouch
H. R. Blackwell	K. M. Reid
R. B. Brown, Jr.	John S. Walsh
O. P. Cleaver	M. N. Waterman

HISTORICAL — To assemble and make available for current reference and to prepare in suitable and durable form for posterity, such historical facts, printed memorabilia, photographs, voice records, museum specimens and allied items as may be judged worthy of composing a continuing digest of the record of the Society's history.

S. G. Hibben, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

R. B. Burton, Sr.	Charles Franck
Julius Daniels	C. A. B. Halvorson
Leo Dolkart	J. L. Stair

G. H. Stickney

LIGHTING SERVICE — To stimulate and promote the discussion and practical application of lighting recommendations and to conduct a Lighting Service Forum in connection with the National Technical Conference.

L. E. Tayler, Chairman, The Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

William T. Clark	Paul H. Hildebrand

MEMBERSHIP — To develop plans and supervise the operation of the individual membership activity of the Society.

T. W. Lauer, Chairman, Ramsey Electric Co., 1007 Arch St., Philadelphia, Pa.

W. A. Stannard, Vice-Chairman, Consumers Power Co., 212 W. Michigan Ave., Jackson, Mich.

J. M. Asher	T. C. Sargent
E. M. Fahey	L. C. Twichell
E. H. Salter	J. S. Walsh

F. C. Winkler

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Ford Bates	J. J. McDonald
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B. F. Kindell	J. M. Whitbeck
J. F. Korba	C. Q. Wiggins, Jr.
Howard Long	C. H. Zurheide

NATIONAL TECHNICAL CONFERENCE — To be completely responsible, subject to the approval of Council, for the general coordination of all conference activities, for selecting and recommending time and place for review of the plans and budgets of the National Technical Conference Executive Committee and in cooperation with the Papers Committee for the satisfactory time allocation for the Technical Papers sessions according to Procedures and Policies as adopted by Council.

C. N. Laupp, Chairman, Wisconsin Electric Power Co., 231 W. Michigan St., Milwaukee, Wis.

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W. W. Booth	C. W. McCormick
G. F. Dean	Glenn E. Park
J. C. Forbes	A. C. Sangster
M. B. Hastings	L. E. Tayler
A. D. Hinckley	A. S. Turner

R. M. Zabel

Conference Executive Committee

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F. L. Detwiler	Mrs. F. E. Mueller
R. N. Green	J. J. Neidhart
Mrs. W. H. Kahler	A. L. Ress
M. E. Keck	R. M. Smart
H. A. Lawrence	N. H. Vacha

T. D. Wakefield

PROCEDURES AND POLICIES—To study problems of Society procedure and policy referred to the Committee by Council, and to formulate recommendations to Council for the statement, revision, or clarification of these procedures and policies consistent with the Constitution and Bylaws of the Society.

G. W. Beals, Chairman, The Miller Co., Meriden, Conn.

C. C. Shotwell	L. C. Twichell
W. A. Stannard	J. S. Walsh
E. M. Strong	J. F. Whitehead, Jr.

F. C. Winkler

PUBLIC RELATIONS AND INFORMATION — To prepare and disseminate information about the activities, accomplishments, program, objectives and policies of the Society and about the place of illuminating engineering in modern society; to formulate and submit public relations policies and plans for the Society.

J. F. Whitehead, Jr., Chairman, Day-Brite Lighting Inc., 5411 Bulwer Ave., St. Louis, Mo.

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A. H. Clarke	R. M. Johannesen
B. C. Cooper	T. W. Lauer
W. A. Dalrymple	C. C. Shotwell

W. R. Wirths

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A. S. Harris	G. A. Watters
Pat Hollingsworth	E. J. Whitlow

M. W. Zeeb

REGIONAL ACTIVITIES — To represent the respective Regions before the Council and to keep the Council informed regarding the affairs of the Regions. To stimulate Society activities, to encourage joint meetings of Sections and Chapters including Regional Conferences within the respective Regions and to promote the expansion of the Society.

M. N. Waterman, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

C. J. Berry	C. W. McCormick
G. B. Buck II	M. J. Myers, Jr.
J. R. Chambers	G. E. Park
D. M. Finch	B. E. Plowman
M. B. Hastings	A. C. Sangster

RESIDENCE LIGHTING FORUMS — To stimulate and assist the Residence Lighting Forums of the Society and to encourage the formation of additional Forums. To conduct a Residence Lighting Forum in connection with the National Technical Conference.

Mary B. Taepke, Chairman, The Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

Edith Buchholtz	Evelyn Herron
Mrs. Ralph L. Bush	Katharine T. Goodall
Mariquita Dygert	Jan Reynolds
Lillian Eddy	Frances E. Rosier
Eve Freyer	Kerr Sanders, Jr.

Virginia Skinner

SUSTAINING MEMBERSHIP—To develop plans and supervise the operation of the Sustaining Membership activity in the Society according to the Procedures and Policies adopted by Council.

C. C. Shotwell, Chairman, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia, Pa.

R. L. Biesele	R. A. Palmer
G. F. Dean	W. E. Potter
Fred Guth	T. C. Sargent
C. R. Long	H. T. Rankin

F. C. Winkler

Section and Chapter Representatives

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Frank T. Anderson	R. L. McCalley
G. W. Beals	G. L. Morris
B. F. Benning	H. D. Morton
Norman Bethune	W. C. Mutchler
J. W. Bigley	H. S. Nonneman
J. L. Booker	Eric Nylund
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J. H. Hull	F. E. Webb
S. E. Jarvis	R. E. White
F. R. Leffler	J. W. Young

TRUSTEES, I.E.S. HEADQUARTERS RETIREMENT PENSION PLAN

E. M. Strong, Chairman, Cornell University, Ithaca, N. Y.

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G. J. Taylor

TASK COMMITTEES

LIGHT'S DIAMOND JUBILEE — 1954

S. G. Hibben, Chairman, Westinghouse Electric Co., Bloomfield, N. J.

Prall Culviner	C. C. Shotwell
C. M. Cutler	R. G. Slauer
R. F. Hartenstein	J. S. Walsh

I.E.S. - U. S. PUBLIC HEALTH SERVICE — To outline a method of making a survey of the visual factors of the working environment and the workers' vision and evaluating the findings in terms of visual comfort and effectiveness and eye health.

J. F. Parsons, Chairman, Niagara Mohawk Power Corp., 535 Washington St., Buffalo 3, N. Y.

B. S. Benson	George Clayton
L. J. Cahill	Neal Jacobus
Mrs. Tula Brocard	A. L. Koven

R. P. Teele

(*Continued on page* 31A)

Here's a ceiling that's completely new ...completely beautiful!

Honeylite aluminum honeycomb is efficient, safe, strikingly beautiful when used in full ceilings or fixture unit lighting. We believe its beauty must be seen to be fully appreciated—technically, the facts speak for themselves, presenting four big reasons for the use of light-diffusing **Honeylite** in office, store and factory:

1 **Honeylite** allows 95%-plus light transmission efficiency throughout lifetime of installation
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"One of the most pleasing features of our newly remodeled main office has been the Honeylite installation."

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Write for technical data and sample

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HONEYLITE

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...with Lighting by LITECONTROL

This superb remodeling job (in a forty-year-old building) needed custom lighting to show it at its best and provide plenty of balanced light for office work. One versatile fixture — LITECONTROL 4044 — does the job perfectly, lights it just the way everyone wants it.

It's well-illuminated (84 footcandles on the second floor), but even and glare-free. And it's economical on every count.

LITECONTROL 4044 is a louvered fixture that can be used in many ways. Here, it's surface mounted on the first floor, mounted on pendants on the second. It can be hung in rows or individually, as over the door. It goes up easily, is easy to clean and relamp. Louvers swing fully open from either side from spring catches.

LITECONTROL versatility means *custom lighting* with standard fixtures. That means *standard prices.* There are twenty-seven basic fixtures that can be combined or modified to light your job the way you want. For lighting or relighting, call your LITECONTROL representative.

INSTALLATION: Time Credit Office, Union Market National Bank, Watertown, Mass.

ARCHITECT: J. Williams Beal Sons, Boston, Mass.

ENGINEER: Lionel G. Gale, Boston, Mass.

DECORATOR: John H. Pray & Sons Co., Boston, Mass.

ELEC. CONTRACTOR: Howes Electric Co., Watertown, Mass.

FIXTURES: No. 4044 4-lamp 40-watt Bipin-louvered, 35°-25° shielding. Surface mounted (1st Floor). On 4" stems (2nd Floor)

CEILING HEIGHT: 11'-0" (1st Floor) — 10'-2" (2nd Floor)

SPACING: 8'-0" on Centers

INTENSITY: 70 Footcandles average in service (1st Floor). 84 Footcandles average in service (2nd Floor)

LC

LITECONTROL

Fixtures

LITECONTROL CORPORATION

36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

TECHNICAL COMMITTEES

AVIATION LIGHTING — To study the application of light and lighting to the spaces and functions involved in the operation of aircraft.

D. C. Miller, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.
H. J. C. Pearson, Vice-Chairman, Civil Aeronautics Administration, Technical Development Division, Indianapolis, Ind.

P. H. Greenlee, Secretary, Grimes Mfg. Co., Urbana, Ohio.

R. J. Stefany, Treasurer, Westinghouse Electric Corp., Bloomfield, N. J.

J. F. Angier	A. L. Lewis
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F. C. Breckenridge	W. A. Pennow
H. A. Cramer	V. J. Roper
C. A. Douglas	L. C. Simpson
I. F. Fagin	R. G. Slauer
W. C. Fisher	L. C. Vipond
J. P. Hoxie	Martin Warskow
G. M. Kevern	A. B. Winters

CIVIL DEFENSE, LIGHTING FOR—To appraise and report on special lighting problems connected with emergency military operations that directly involve civilian defense and protection, such as equipment for bomb shelters, special street and vehicular lighting, mobile self-contained lighting facilities for use in bombed areas, and emergency lighting devices and visual aids to movement in the event of power failure.

J. C. Forbes, Co-Chairman, General Electric Co., Nela Park, Cleveland, Ohio.
J. W. Bateman, Co-Chairman, Canadian General Electric Co, Ltd., 165 Dufferin St., Toronto, Ont.

J. S. Walsh, Secretary, Pacific Gas & Electric Co., 245 Market St., San Francisco., Calif.

Subcommittee on Development of Technical Booklet

R. B. Brown, Jr., Chairman, Boston Edison Co., 39 Boylston St., Boston, Mass.

J. E. Dawson	J. W. Lee
R. M. Hoot	A. A. Pierce
Merle Keck	R. P. Teele

J. W. Young

COLOR AND ILLUMINATION — To study, evaluate and report on the effect of color in relation to the art and science of illumination.

R. C. Allison, Chairman, T. Eaton Co., 190 Yonge St., Toronto, Ont.
W. C. Granville, Vice-Chairman, Container Corp. of America, 38 S. Dearborn St., Chicago, Ill.

R. L. Biesele, Jr.	Harry Helson
A. A. Brainerd	C. F. Jensen
L. H. Brown	W. H. Kahler
R. A. Boyd	Richard Kelly
C. L. Cottrell	H. L. Logan
C. R. Conquergood	J. A. Meacham
G. F. Dean	Gladys Miller
R. M. Evans	Dorothy Nickerson
Dean Farnsworth	W. D. Riddle
C. E. Foss	Francis Scofield
S. K. Guth	D. E. Spencer
R. M. Hanes	G. F. Wakefield

DAYLIGHTING — To study the problems involved in daylighting, develop recommended practices and report thereon.

R. A. Miller, Chairman, Pittsburgh Plate Glass Co., 420 Fort Duquesne Blvd., Pittsburgh, Pa.
H. B. Vincent, Vice-Chairman, Owens-Illinois Glass Co., 1700 N. Westwood Ave., Toledo, Ohio.

W. J. Arner	W. B. Ewing
L. E. Barbrow	W. E. Folsom
G. F. Bauer	B. F. Greene
R. L. Biesele, Jr.	C. D. Gibson
R. A. Boyd	J. W. Griffith
A. A. Brainerd	H. S. Herbert
H. S. Bull	G. N. Hingston
W. W. Caudill	H. F. Kingsbury
E. W. Conover	F. L. Knowles
Doyt Early	K. M. Laing
W. F. Little	D. R. Muir
W. O. Lytle	S. W. Quisenberry
T. H. MacDonald	W. C. Randall
H. E. Machamer	R. H. Reed
Murray McDavitt	F. K. Sampson
R. W. McKinley	D. E. Spencer
J. A. Meacham	E. E. Vezey
E. C. Miles	Andrew Vogel
Parry Moon	K. C. Welch

O. F. Wenzler

FARM LIGHTING — To study the application of light and lighting of farm buildings, surrounding work areas and other rural locations and to report thereon.

O. C. Lange, Chairman, Pennsylvania Power & Light Co., 9th & Hamilton Sts., Allentown, Pa.

T. M. Barr	L. E. Innis
Edith Buchholtz	Arthur Kramer
J. P. Ditchman	Howard Long
O. D. Hunt	Joseph Schaenzer

A. J. VonBurg

I.E.S. - A.S.H.V.E. JOINT COMMITTEE — To study the relationship between lighting and various factors that enter into the thermal environment and report thereon.

Walter Sturrock, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

R. W. McKinley	E. H. Salter

A.S.H.V.E. Cooling Load Subcommittee

John Everetts, Jr.	A. T. Jorn

J. N. Livermore

ILLUMINATION PERFORMANCE RECOMMENDATIONS — To prepare illumination performance recommendations for luminaires conforming to CIE classifications, excluding residential.

B. S. Benson, Jr., Chairman, Benjamin Electric Mfg. Co., Des Plaines, Ill.

R. D. Burnham	J. F. Parsons
G. W. Clark	E. H. Salter
Kurt Franck	R. P. Teele
W. H. Kahler	William Weibel

INDUSTRIAL LIGHTING — To initiate, follow up and coordinate lighting study projects in the industrial field, review the reports of the various subcommittees in this field and make recommendations to Council.

Lighting of Central Station Properties

L. G. Parks, Chairman, Ebasco Services Inc., 2 Rector St., New York, N. Y.

A. A. Brainerd	H. E. D'Andrade
R. S. Bucher	J. E Kaufman
H. F. Carroll	E. A Linsday
H. A. Cook	D. J. O'Neill
R. W. Corwin	C. B. Stephens

D. W. Taylor

Lighting in the Clothing Industry

Norman Kridel, Chairman, Rochester Gas and Electric Co., 89 East Ave., Rochester, N. Y.

L. Gauthier	B. A. Thomas
W. E. Hayes	L. C. Twichell

Carl Uthe

Lighting in Foundries

E. A. Linsday, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

Lighting for Graphic Arts—Printing Industry

Ralph Enghouser, Chairman, Sylvania Electric Products, Inc., 1938 Lincoln Liberty Bldg., Philadelphia, Pa.

Michael Flynn	John Mucha
William Harrison	Robert E. Rossell
Percy Holmes	Warren B. Reese

J. Wallace Scott

Subcommittee on Color Appraisal

Philip E. Tobias, Chairman, Edward Stern & Co., Philadelphia, Pa.

Norman Macbeth, Vice-Chairman, Macbeth Corp., Newburgh, N. Y.

Fred Bahls	W. B. Reese
P. R. Holmes	Phillip Simone
E. A. Linsday	G. W. Youngiove

Lighting in Laundries

A. A. Sobolik, Jr., Chairman, Public Service Co. of Northern Illinois, 1701 South First Ave., Maywood, Ill.

G. F. Allen	R. R. Hill
J. R. Chambers	Carl F. Jensen
A. L. Christensen	R. R. Lusk
O. A. Hill	W. S. E. Miller

Mine Lighting

C. M. Crysler, Chairman, General Electric Co., 238 W. Carson St., Pittsburgh, Pa.

A. E. Krawcek

Outdoor Productive Areas

R. H. Goodman, Chairman, Crouse-Hinds Co., Syracuse, N. Y.

H. N. McIntyre	W. R. Davies

Petroleum Industry

Dale H. Watt, Chairman, Watt Plumbing, Air-conditioning & Electric Co., Tulsa, Okla.

Richard Askew	H. D. Hughes
R. H. Bowyer	F. F. House
J. G. Felton	H. F. Miller
W. E. Folsom	P. R. Sheline

T. C. Wier

Sawmills

James Barnes, Chairman, Pacific Gas & Electric Co., North Bay Division, P.O. Box 540, San Rafael, Calif.

D. M. Finch	D. King
Emanuel Fritz	Norman Schiewe
Jerry Howard	P. S. Schmidt
John Keyes	K. B. Stoddard

Sheet Metal, Stamping, Folding and Shearing Industry

Floyd W. Sell, Chairman, Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

H. A. Boltz	J. M. Marlin
E. L. Frase	T. H. Roughley

Donald Thiesen

Textile Industry

(Joint Committee with A.S.M.E.)
Carl M. Holden, Chairman, Champion Lamp Works, 600 Broad St., Lynn, Mass.

INSTITUTIONAL — To initiate, follow up and coordinate lighting study projects in the field of public buildings and private institutions, review the reports of the various study subcommittees in this field and make recommendations to Council.

James H. McCulloch, Chairman, 421 W. Swisher St., Danville, Ill.

Joel Rubin	George Smedberg
C. I. Sayles	W. H. Smith
R. M. Smart	Carl Zersen

Auditoriums and Churches

George Shoemaker, Chairman, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia, Pa.

Hospitals

William H. Smith, Chairman, 20 South Senate, Indianapolis, Ind.

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Joseph C. Bozik	E. H. Greppin
B. C. Cooper	N. L. Griffin
R. E. Crockett	Howard Haynes
E. R. Domoney	Paul Seagers

E. C. Swenson

Hotels

C. I. Sayles, Chairman, Cornell University, School of Hotel Administration, Ithaca, N. Y.

C. L. Cottrell	J. Fassett
H. E. D'Andrade	Francis Keally
Myrtle Fahsbender	F. B. Mills

Kitchens

Carl Zersen, Chairman, Chicago Lighting Institute, 37 So. Wabash Ave., Chicago, Ill.

Theaters

Joel Rubin, Chairman, Kliegl Bros., Inc., 321 W. 50th St., New York, N. Y.

Jules C. Berinstein	G. T. Howard
Alfred Boylen	H. D. Sellman
T. W. Butler	George Smedberg
Theodore Fuchs	Rollo G. Williams

LIGHT CONTROL AND EQUIPMENT DESIGN—Collect and correlate the knowledge and data on means and methods of controlling, directing, reflecting, transmitting and diffusing light and on the principles and practices of equipment design.

D. L. Williams, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

F. M. Neal, Vice-Chairman, Corning Glass Works, Corning, N. Y.

G. R. Baumgartner	M. P. Morse
B. S. Benson, Jr.	C. N. Sprankle
R. D. Bradley	M. Trostle
G. C. Moore	William Weibel

F. C. Winkler

Joint Subcommittee—I.E.S., S.P.I. and N.E.M.A.

F. C. Winkler, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland, Ohio. W. C. Goggins, Vice-Chairman, The Dow Chemical Co., Midland, Mich.

R. D. Bradley	Carl O. Massopust
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(*Continued on page* 34A)

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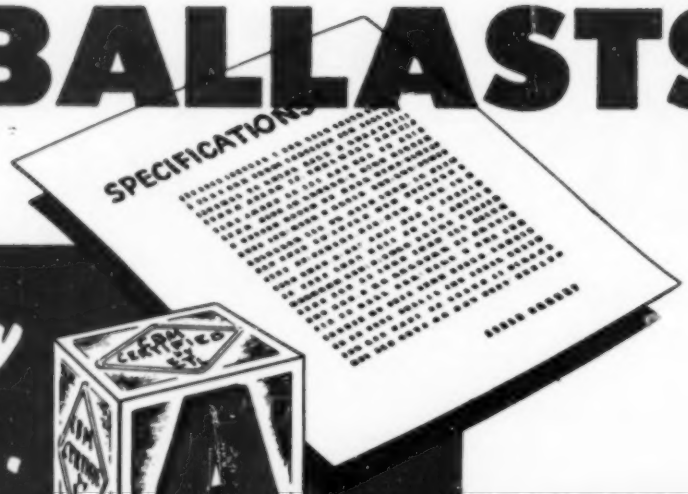

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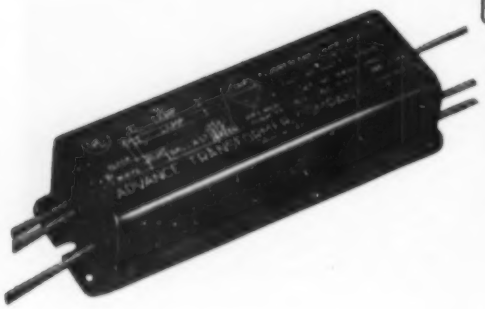

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(Continued from page 22A)

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(Continued on page 46A)

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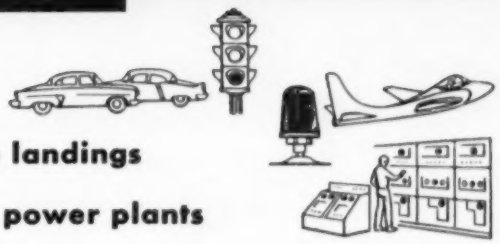

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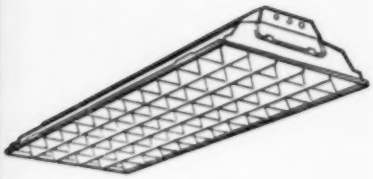

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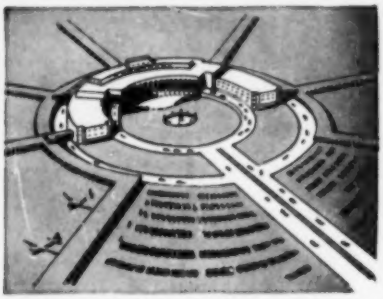

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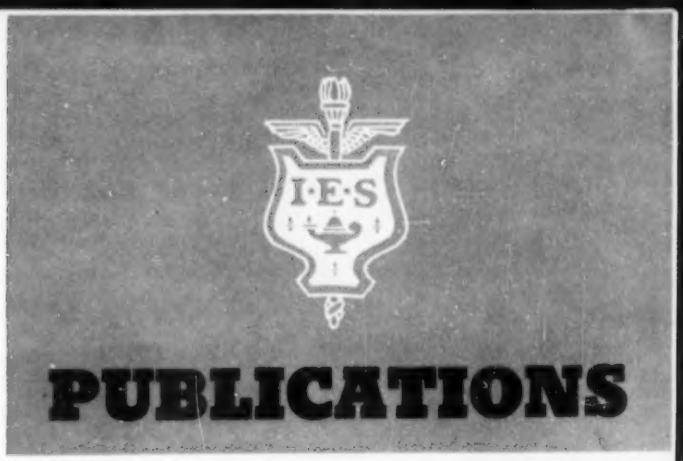

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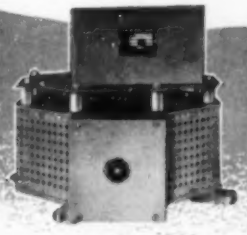

NON-INTERLOCKING LUXTROL LIGHT CONTROL EQUIPMENT

Ideal for auditorium or single room lights where only a few circuits require control. Manually operated or motor driven assemblies. Capacities from 1,000 to 30,000 watts.

INTERLOCKING LUXTROL LIGHT CONTROL EQUIPMENT

Single units or assemblies for mounting in factory framed assemblies. With or without mastering or grand mastering controls. Can be engineered to meet all power control requirements.

THE POSITIONER SYSTEM OF LUXTROL LIGHT CONTROL EQUIPMENT

Motor-driven LUXTROL control assemblies remotely-controlled from compact selector stations located at point of greatest convenience or from portable box.

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Please send full information about LUXTROL light control equipment:

☐ Packaged Assemblies ☐ Interlocking Types
☐ Non-Interlocking Types ☐ The Positioner System

Name.....

Company Name.....

Company Address.....

City.....Zone.....State.....

(Continued from page 38A)

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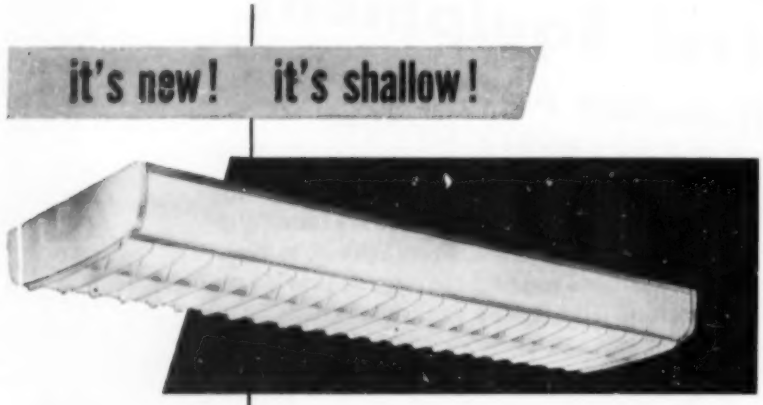

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- Unit is wired complete, ready to install in line or individually. Finished in all-white. U.L. listed.

Write for Bulletin N
It gives complete specifications, dimensional drawings and engineering data for the Garfield.

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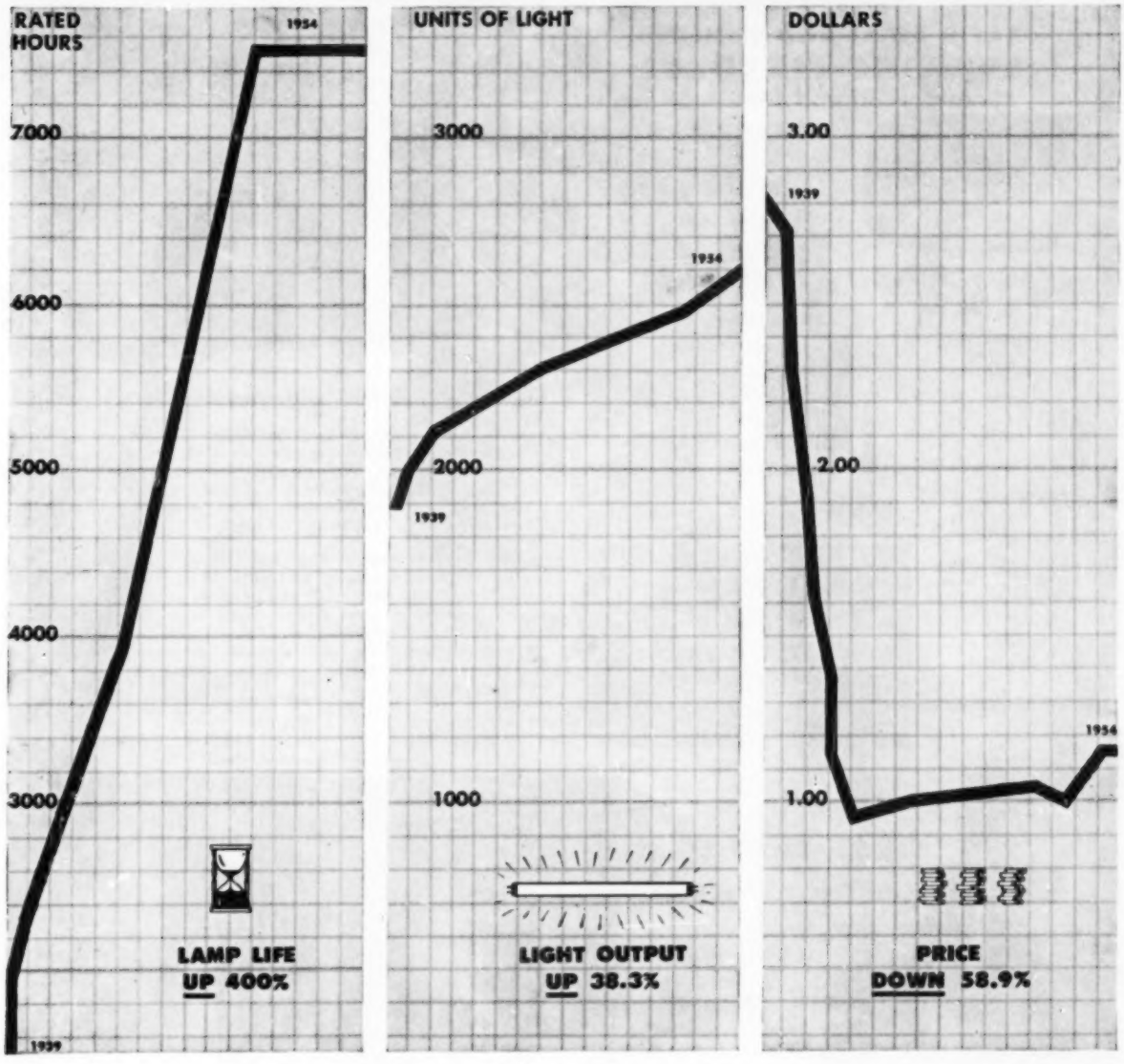

16 times more value for your fluorescent lamp dollar than in 1939

Today you don't have to pay more than $1.15 for the finest fluorescent lamp made: General Electric. Fifteen years ago it would have cost you $2.80 or $1.65 more. And while price has been going down, we've been pushing quality up. General Electric has upped light output 38%, increased lamp life 400%.

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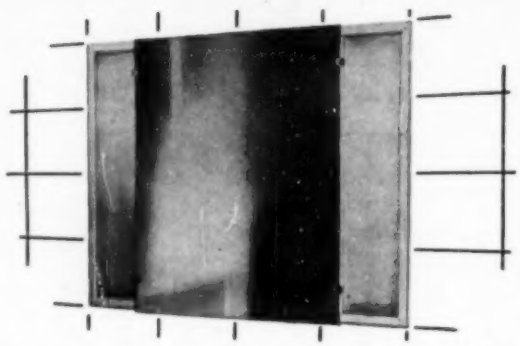

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Now you can easily specify good lighting for the bathroom, too! The Milwaukee cabinet provides completely recessed lighting—for glareless, shadowless illumination. With *four* 20-watt fluorescent lamps, no other illumination is ordinarily needed in the bathroom. For all other facts on this most modern of bathroom cabinets, write for bulletin B-108. Or see your electrical wholesaler . . . today.

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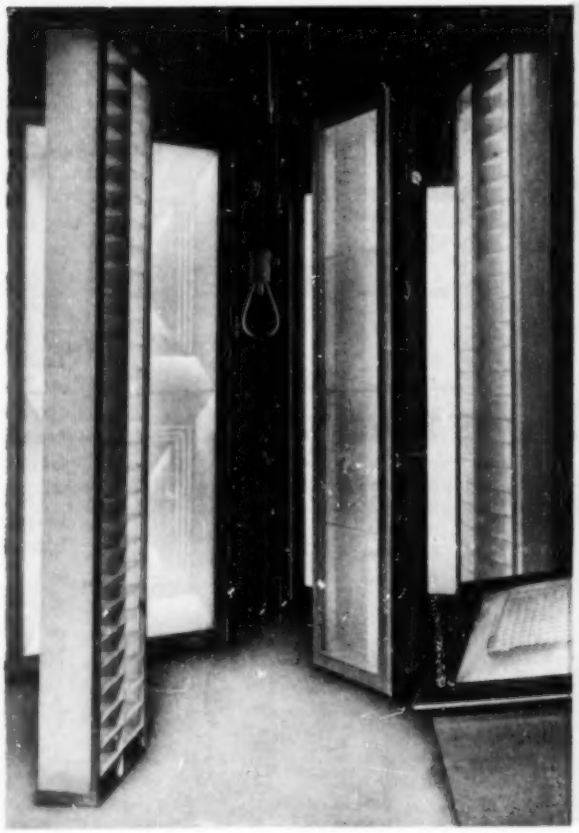

SUNBEAM LIGHTING COMPANY
777 East 14th Pl., Los Angeles 21, Calif.

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